

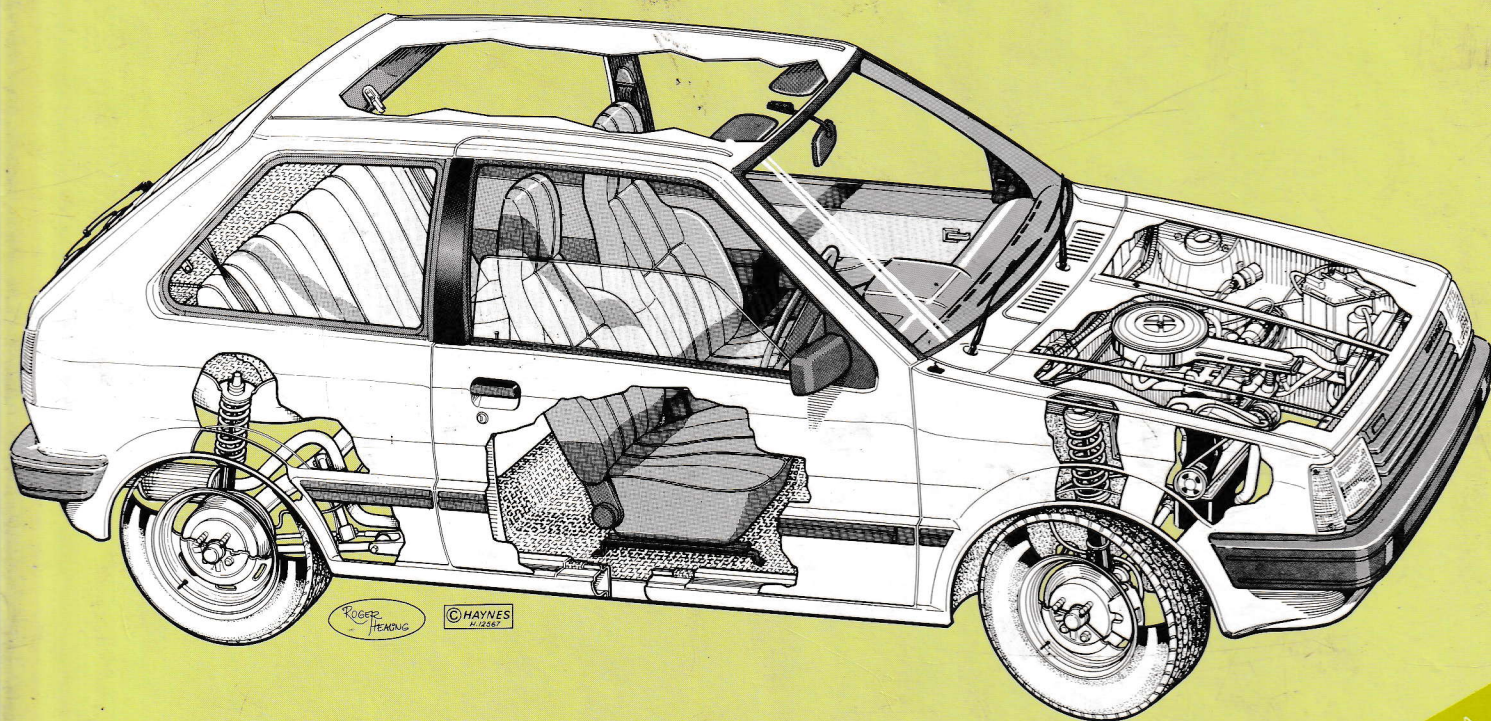
# NISSAN MICRA

1983 to 1988  
All models □ 988 cc



THE  
BOOK

## Owners Workshop Manual



EVERY MANUAL BASED ON A  
COMPLETE STRIPDOWN  
AND REBUILD

# Models covered by this manual

Nissan Micra (K10 series) L, DX, Colette, GL, SGL, LS and GSX  
3-door and 5-door Hatchback; 988 cc

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# Nissan Micra Owners Workshop Manual

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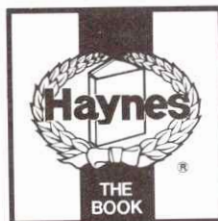
Colin Brown

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**Models covered**

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3-door and 5-door Hatchback; 988 cc

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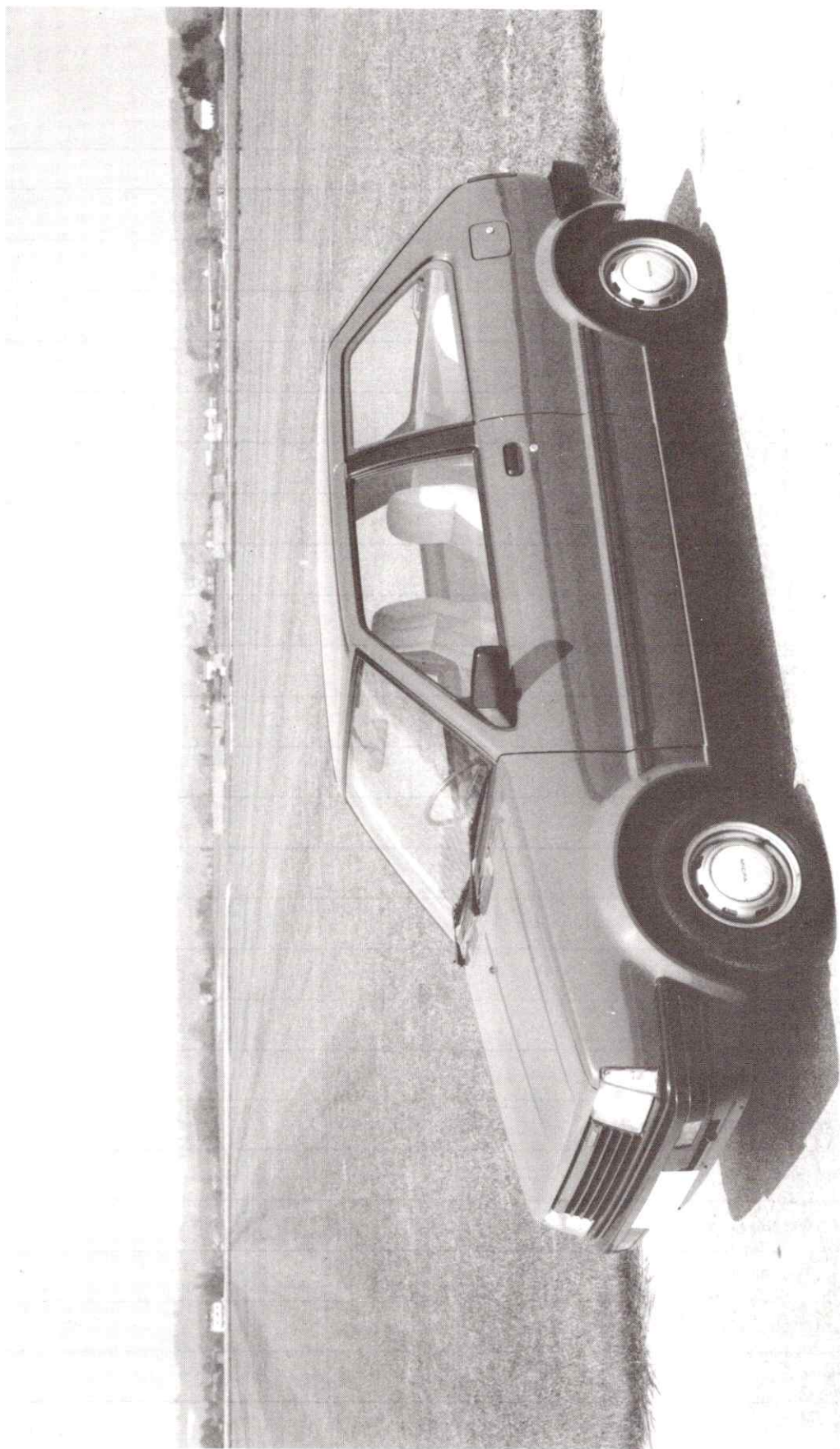
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Nissan Micra GL

# About this manual

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## *Its aim*

The aim of this manual is to help you get the best value from your vehicle. It can do so in several ways. It can help you decide what work must be done (even should you choose to get it done by a garage), provide information on routine maintenance and servicing, and give a logical course of action and diagnosis when random faults occur. However, it is hoped that you will use the manual by tackling the work yourself. On simpler jobs it may even be quicker than booking the car into a garage and going there twice, to leave and collect it. Perhaps most important, a lot of money can be saved by avoiding the costs a garage must charge to cover its labour and overheads.

The manual has drawings and descriptions to show the function of the various components so that their layout can be understood. Then the tasks are described and photographed in a step-by-step sequence so that even a novice can do the work.

## *Its arrangement*

The manual is divided into thirteen Chapters, each covering a logical sub-division of the vehicle. The Chapters are each divided into Sections, numbered with single figures, eg 5; and the Sections into paragraphs (or sub-sections), with decimal numbers following on from the Section they are in, eg 5.1, 5.2, 5.3 etc.

It is freely illustrated, especially in those parts where there is a detailed sequence of operations to be carried out. There are two forms of illustration: figures and photographs. The figures are numbered in sequence with decimal numbers, according to their position in the Chapter – eg Fig. 6.4 is the fourth drawing/illustration in Chapter 6. Photographs carry the same number (either individually or in related groups) as the Section or sub-section to which they relate.

There is an alphabetical index at the back of the manual as well as a contents list at the front. Each Chapter is also preceded by its own individual contents list.

References to the 'left' or 'right' of the vehicle are in the sense of a person in the driver's seat facing forwards.

Unless otherwise stated, nuts and bolts are removed by turning anti-clockwise, and tightened by turning clockwise.

Vehicle manufacturers continually make changes to specifications and recommendations, and these, when notified, are incorporated into our manuals at the earliest opportunity.

**Whilst every care is taken to ensure that the information in this manual is correct, no liability can be accepted by the authors or publishers for loss, damage or injury caused by any errors in, or omissions from, the information given.**

# Introduction to the Nissan Micra

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The Nissan Micra was introduced to the UK in June 1983, and quickly established itself in the small economy car class.

The range of models was revised in June 1985, when the SGL was added; mechanically similar to the preceding L, DX and GL models, but with higher trim level. Other cosmetic changes were also made at this time, to update the appearance of the model.

In February 1986, Nissan introduced the Colette, with a high level of trim, but using a low compression engine and 4-speed manual

gearbox for economy motoring.

In 1987, the range of models was again revised, and 5-door models became available. The development continued when, in 1988, the higher specification 'S' series was introduced.

All versions use the 988cc MA10 overhead camshaft engine, mounted transversely and driving the front wheels. The vehicle is quite conventional in design and the DIY home mechanic should find most maintenance tasks quite straightforward.



Nissan Micra Colette (3-door)

# General dimensions, weights and capacities

*For information applicable to later models, see Supplement at end of manual*

## Dimensions mm (in)

Overall length .....	3645 (143.5)
Overall width .....	1560 (61.4)
Overall height .....	1395 (54.9)
Ground clearance .....	165 (6.5)
Wheelbase .....	2300 (90.6)
Turning circle .....	9.8 metre (32.2 ft)

## Kerb weights kg (lb)

Manual transmission .....	645 (1420)
Automatic transmission .....	675 (1490)

## Capacities

Fuel tank .....	8.8 Imp gal (40 litre)
Cooling system:	
Including heater .....	6.86 Imp pt (3.9 litre)
Excluding heater .....	6.16 Imp pt (3.5 litre)
Expansion tank .....	1.40 Imp pt (0.8 litre)
Engine oil:	
With oil filter .....	4.75 Imp pt (2.7 litre)
Without oil filter .....	4.22 Imp pt (2.4 litre)
Transmission and final drive:	
Manual transmission .....	4.5 Imp pt (2.6 litre)
Automatic transmission .....	10.6 Imp pt (6.0 litre)
Power steering system .....	1.7 Imp pt (1.0 litre)
Water reservoirs:	
Windscreen wash .....	2.6 Imp pt (1.5 litre)
Windscreen and rear screen wash .....	5.2 Imp pt (3.0 litre)

# Jacking, wheel changing and towing

## Jacking

The jack supplied with the vehicle should only be used for emergency roadside wheel changing (photo).

The roadwheels on the opposite side to those being worked on should be chocked. Put manual transmission vehicles in reverse gear and automatic transmission vehicles to P. Apply the handbrake in all cases. **Caution:** ensure the vehicle is standing on firm, level ground before jacking.

Place the jack under the cut-out in the base of the sill (front or rear, as required), and slowly raise the vehicle by turning the cranked jack handle clockwise. When the vehicle is raised, supplement the jack with axle stands.

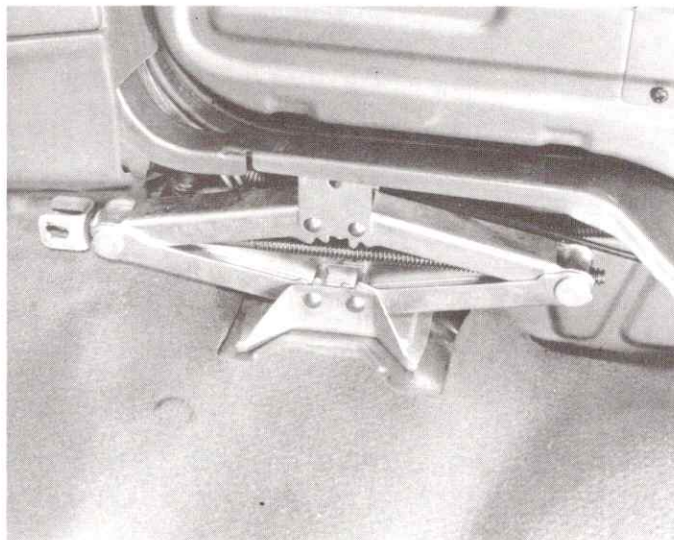
## Wheel changing

Prepare the vehicle as described in the preceding paragraphs, but do not raise the vehicle at this stage.

Remove the centre cap of the wheel and loosen the wheel nuts one or two turns by turning them anti-clockwise with the wheel nut wrench. Do not remove the wheel nuts completely until the vehicle is off the ground.

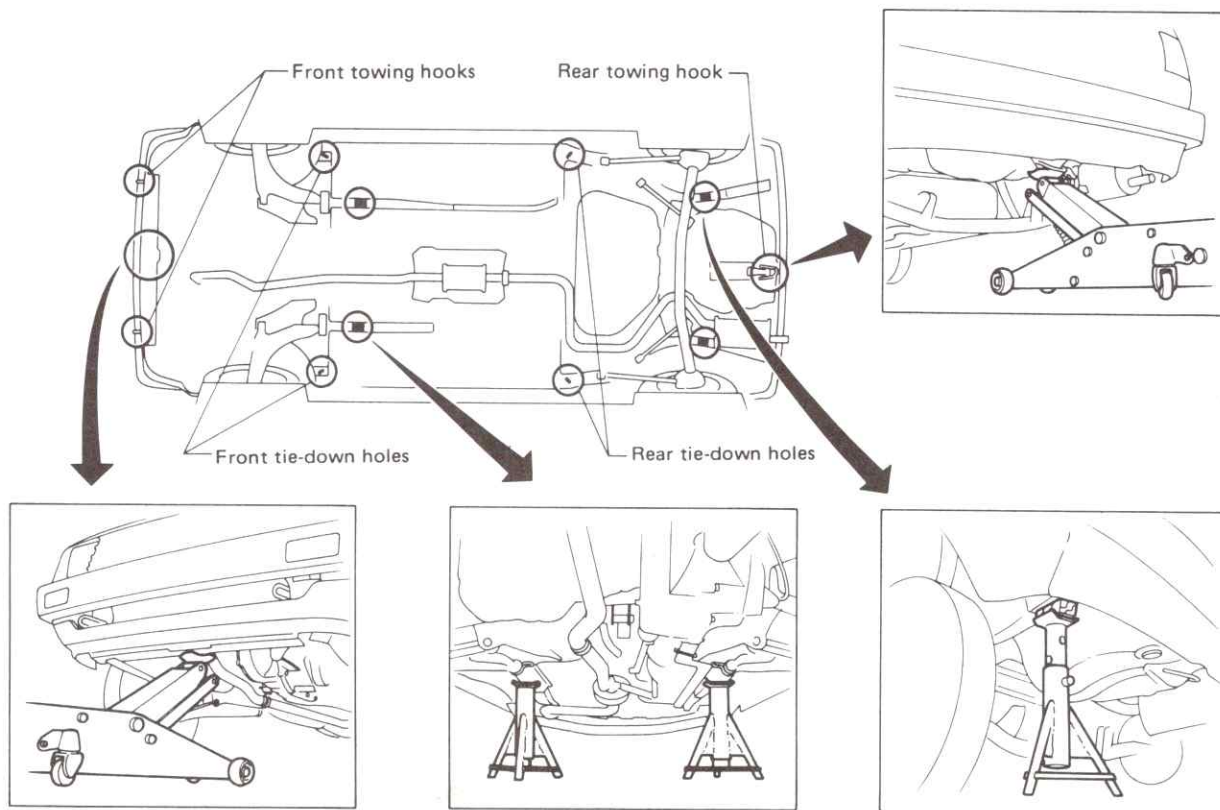
Raise the vehicle slowly until the wheel is clear of the ground. Remove the wheel nuts and the wheel. Position the spare wheel onto the studs and refit the wheel nuts, bevelled ends facing inward.

Tighten the wheel nuts evenly and in an alternate pattern.



Jack stowage in luggage compartment

Place a wood or rubber block between safety stand and vehicle body when the supporting body is flat.



Jacking, axle stand and towing points

Where aluminium wheels are fitted, use only the nuts designed for these wheels. When refitting the nuts, slightly pull back the wheel to align the nuts with the bolt holes in the wheel, and again tighten the nuts evenly and alternately.

Lower the vehicle to the ground by turning the jack handle anti-clockwise.

Remove the jack from the jacking point.

Tighten the wheel nuts to the specified torque. Where this operation is done at the roadside, torque tightening should be carried out at the earliest opportunity, and with aluminium wheels, should be rechecked after 1000 km (600 miles).

### Towing

Two towing eyes are provided at the front of the vehicle and one at the rear (photos). These towing eyes should only be used for short distances, and if the transmission is faulty, then a proper towing dolly should be used, which raises the front wheels (the driven wheels) off the ground.

Before towing commences, put the gearbox in neutral and release the handbrake. The ignition key should remain in the OFF position to prevent the steering lock from locking.

Towing speeds should be restricted as follows:

Manual gearbox .....	50 mph (80 km/h)
Automatic gearbox .....	20 mph (30 km/h)

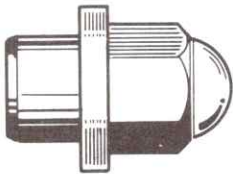
Towing distance should be restricted as follows:

Manual gearbox .....	50 miles (80 km)
Automatic gearbox .....	20 miles (30 km)

**Warning:** Vehicles with an automatic gearbox should never be towed with the front (driven) wheels on the ground, as this can cause serious damage to the transmission. A towing dolly should always be used.

Also, when towing with the rear wheels raised do not rely on the steering lock mechanism to lock the wheels. Use a proper locking bar, or in an emergency tie the steering wheel in the straight-ahead position with rope.

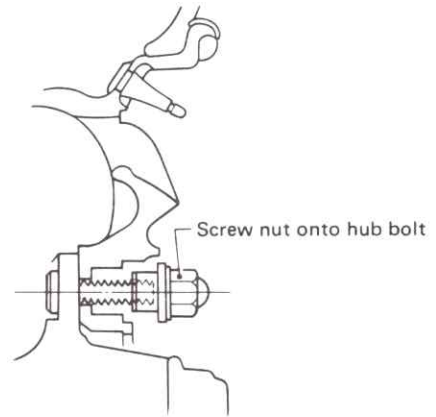
For aluminium  
wheels only



For steel  
wheels only



Wheel nuts for alloy and steel wheels



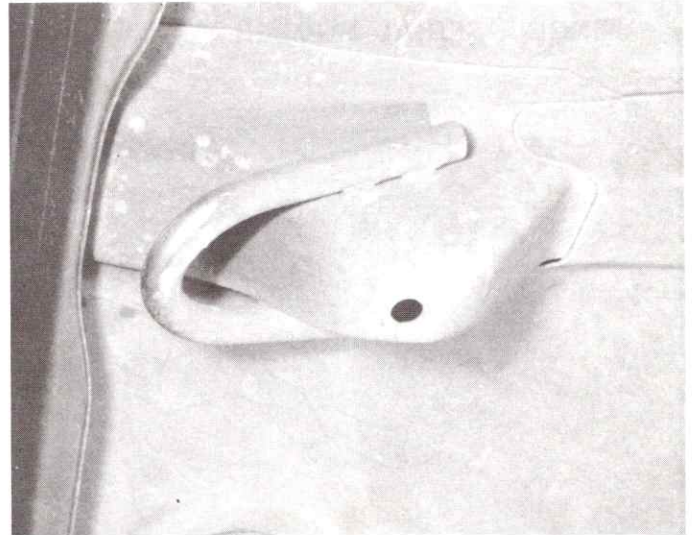
Correct fitment of alloy wheel nuts



Spare wheel stowage under luggage compartment floor



Front towing eye



Rear towing eye

# Buying spare parts and vehicle identification numbers

## Buying spare parts

Spare parts are available from many sources for example: Nissan garages, other garages and accessory shops or motor factors. Our advice concerning spare parts is as follows.

### Officially appointed Nissan dealers

The best source for parts which are peculiar to the vehicle and generally not available elsewhere (eg cylinder heads, internal engine or gearbox components, interior trim etc). They are also the only place where you should buy parts if the vehicle is still under warranty. Non-standard parts may invalidate the warranty.

To be sure of obtaining the correct part, your garage will need to know the vehicle or engine serial number, and if possible, take the old part with you for further identification. Remember, some parts are available on a factory exchange basis, any parts being returned should be clean.

Other garages and accessory shops may often be very good places to buy components such as spark plugs, light bulbs, windscreen wiper blades, oils and greases, needed for the correct maintenance of your vehicle.

## Motor factors

Good motor factors carry stock of all the major components with a high turnover such as clutches, brake shoes/pads, exhaust systems, batteries etc. and some may also run an exchange system for reconditioned parts which can be considerably cheaper than new parts. A word of warning: beware of cheap inferior parts. They may be cheaper and look right, but often wear out quickly, and can cause problems with adjustments and overall running efficiency.

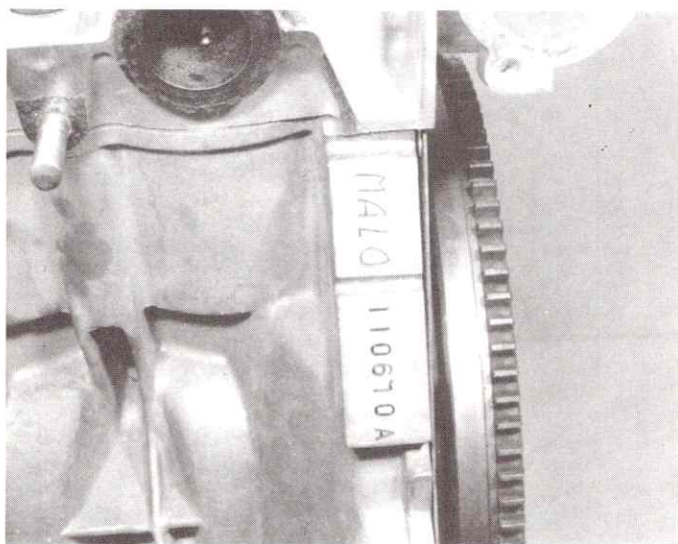
Always use a reputable dealer for your spare parts.

## Vehicle identification numbers

There are two plates located on the engine bulkhead. The right-hand one is the vehicle identification plate and the left-hand one the vehicle identification number. There is also a tyre information plate inside the left-hand door pillar.

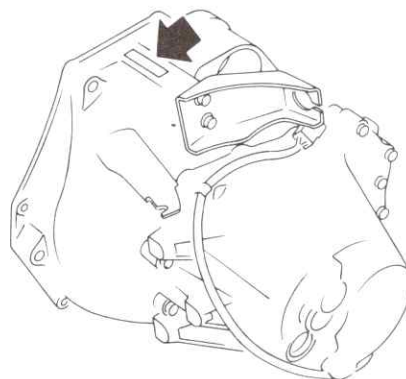
The engine number is stamped on the machined face of the crankcase just below the distributor (photo).

The manual gearbox number is located on the top housing web and automatic transmission number on the top control central housing.

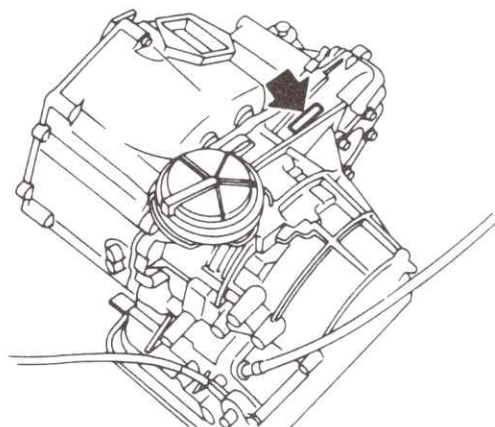


Engine identification number

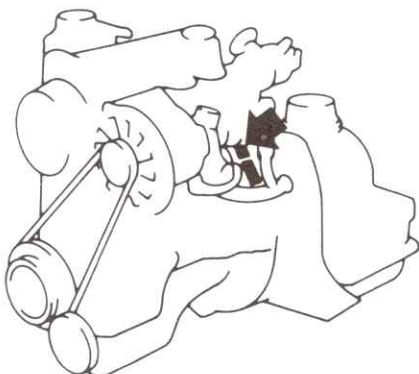
## MANUAL TRANSAXLE NUMBER



## AUTOMATIC TRANSAXLE NUMBER



## ENGINE SERIAL NUMBER



Engine and transmission serial number locations

# General repair procedures

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Whenever servicing, repair or overhaul work is carried out on the car or its components, it is necessary to observe the following procedures and instructions. This will assist in carrying out the operation efficiently and to a professional standard of workmanship.

## *Joint mating faces and gaskets*

Where a gasket is used between the mating faces of two components, ensure that it is renewed on reassembly, and fit it dry unless otherwise stated in the repair procedure. Make sure that the mating faces are clean and dry with all traces of old gasket removed. When cleaning a joint face, use a tool which is not likely to score or damage the face, and remove any burrs or nicks with an oilstone or fine file.

Make sure that tapped holes are cleaned with a pipe cleaner, and keep them free of jointing compound if this is being used unless specifically instructed otherwise.

Ensure that all orifices, channels or pipes are clear and blow through them, preferably using compressed air.

## *Oil seals*

Whenever an oil seal is removed from its working location, either individually or as part of an assembly, it should be renewed.

The very fine sealing lip of the seal is easily damaged and will not seal if the surface it contacts is not completely clean and free from scratches, nicks or grooves. If the original sealing surface of the component cannot be restored, the component should be renewed.

Protect the lips of the seal from any surface which may damage them in the course of fitting. Use tape or a conical sleeve where possible. Lubricate the seal lips with oil before fitting and, on dual lipped seals, fill the space between the lips with grease.

Unless otherwise stated, oil seals must be fitted with their sealing lips toward the lubricant to be sealed.

Use a tubular drift or block of wood of the appropriate size to install the seal and, if the seal housing is shouldered, drive the seal down to the shoulder. If the seal housing is unshouldered, the seal should be fitted with its face flush with the housing top face.

## *Screw threads and fastenings*

Always ensure that a blind tapped hole is completely free from oil, grease, water or other fluid before installing the bolt or stud. Failure to

do this could cause the housing to crack due to the hydraulic action of the bolt or stud as it is screwed in.

When tightening a castellated nut to accept a split pin, tighten the nut to the specified torque, where applicable, and then tighten further to the next split pin hole. Never slacken the nut to align a split pin hole unless stated in the repair procedure.

When checking or retightening a nut or bolt to a specified torque setting, slacken the nut or bolt by a quarter of a turn, and then retighten to the specified setting.

## *Locknuts, locktabs and washers*

Any fastening which will rotate against a component or housing in the course of tightening should always have a washer between it and the relevant component or housing.

Spring or split washers should always be renewed when they are used to lock a critical component such as a big-end bearing retaining nut or bolt.

Locktabs which are folded over to retain a nut or bolt should always be renewed.

Self-locking nuts can be reused in non-critical areas, providing resistance can be felt when the locking portion passes over the bolt or stud thread.

Split pins must always be replaced with new ones of the correct size for the hole.

## *Special tools*

Some repair procedures in this manual entail the use of special tools such as a press, two or three-legged pullers, spring compressors etc. Wherever possible, suitable readily available alternatives to the manufacturer's special tools are described, and are shown in use. In some instances, where no alternative is possible, it has been necessary to resort to the use of a manufacturer's tool and this has been done for reasons of safety as well as the efficient completion of the repair operation. Unless you are highly skilled and have a thorough understanding of the procedure described, never attempt to bypass the use of any special tool when the procedure described specifies its use. Not only is there a very great risk of personal injury, but expensive damage could be caused to the components involved.

# Tools and working facilities

## Introduction

A selection of good tools is a fundamental requirement for anyone contemplating the maintenance and repair of a motor vehicle. For the owner who does not possess any, their purchase will prove a considerable expense, offsetting some of the savings made by doing-it-yourself. However, provided that the tools purchased are of good quality, they will last for many years and prove an extremely worthwhile investment.

To help the average owner to decide which tools are needed to carry out the various tasks detailed in this manual, we have compiled three lists of tools under the following headings: *Maintenance and minor repair*, *Repair and overhaul*, and *Special*. The newcomer to practical mechanics should start off with the *Maintenance and minor repair* tool kit and confine himself to the simpler jobs around the vehicle. Then, as his confidence and experience grow, he can undertake more difficult tasks, buying extra tools as, and when, they are needed. In this way, a *Maintenance and minor repair* tool kit can be built-up into a *Repair and overhaul* tool kit over a considerable period of time without any major cash outlays. The experienced do-it-yourselfer will have a tool kit good enough for most repair and overhaul procedures and will add tools from the *Special* category when he feels the expense is justified by the amount of use to which these tools will be put.

It is obviously not possible to cover the subject of tools fully here. For those who wish to learn more about tools and their use there is a book entitled *How to Choose and Use Car Tools* available from the publishers of this manual.

## Maintenance and minor repair tool kit

The tools given in this list should be considered as a minimum requirement if routine maintenance, servicing and minor repair operations are to be undertaken. We recommend the purchase of combination spanners (ring one end, open-ended the other); although more expensive than open-ended ones, they do give the advantages of both types of spanner.

- Combination spanners - 10, 11, 12, 13, 14 & 17 mm
- Adjustable spanner - 9 inch
- Gearbox drain plug key
- Spark plug spanner (with rubber insert)
- Spark plug gap adjustment tool
- Set of feeler gauges
- Brake bleed nipple spanner
- Screwdriver - 4 in long x  $\frac{1}{4}$  in dia (flat blade)
- Screwdriver - 4 in long x  $\frac{1}{4}$  in dia (cross blade)
- Combination pliers - 6 inch
- Hacksaw (junior)
- Tyre pump
- Tyre pressure gauge
- Grease gun
- Oil can
- Fine emery cloth (1 sheet)
- Wire brush (small)
- Funnel (medium size)

## Repair and overhaul tool kit

These tools are virtually essential for anyone undertaking any major repairs to a motor vehicle, and are additional to those given in the *Maintenance and minor repair* list. Included in this list is a comprehensive set of sockets. Although these are expensive they will be found invaluable as they are so versatile - particularly if various drives are included in the set. We recommend the  $\frac{1}{2}$  in square-drive type, as this can be used with most proprietary torque wrenches. If you cannot afford a socket set, even bought piecemeal, then inexpensive tubular box spanners are a useful alternative.

The tools in this list will occasionally need to be supplemented by tools from the *Special* list.

- Sockets (or box spanners) to cover range in previous list
- Reversible ratchet drive (for use with sockets)
- Extension piece, 10 inch (for use with sockets)
- Universal joint (for use with sockets)
- Torque wrench (for use with sockets)
- 'Mole' wrench - 8 inch
- Ball pein hammer
- Soft-faced hammer, plastic or rubber
- Screwdriver - 6 in long x  $\frac{5}{16}$  in dia (flat blade)
- Screwdriver - 2 in long x  $\frac{5}{16}$  in square (flat blade)
- Screwdriver -  $1\frac{1}{2}$  in long x  $\frac{1}{4}$  in dia (cross blade)
- Screwdriver - 3 in long x  $\frac{1}{8}$  in dia (electricians)
- Pliers - electricians side cutters
- Pliers - needle nosed
- Pliers - circlip (internal and external)
- Cold chisel -  $\frac{1}{2}$  inch
- Scriber
- Scraper
- Centre punch
- Pin punch
- Hacksaw
- Valve grinding tool
- Steel rule/straight-edge
- Allen keys
- Selection of files
- Wire brush (large)
- Axle-stands
- Jack (strong trolley or hydraulic type)

## Special tools

The tools in this list are those which are not used regularly, are expensive to buy, or which need to be used in accordance with their manufacturers' instructions. Unless relatively difficult mechanical jobs are undertaken frequently, it will not be economic to buy many of these tools. Where this is the case, you could consider clubbing together with friends (or joining a motorists' club) to make a joint purchase, or borrowing the tools against a deposit from a local garage or tool hire specialist.

The following list contains only those tools and instruments freely available to the public, and not those special tools produced by the

vehicle manufacturer specifically for its dealer network. You will find occasional references to these manufacturers' special tools in the text of this manual. Generally, an alternative method of doing the job without the vehicle manufacturers' special tool is given. However, sometimes, there is no alternative to using them. Where this is the case and the relevant tool cannot be bought or borrowed, you will have to entrust the work to a franchised garage.

*Valve spring compressor*  
*Piston ring compressor*  
*Balljoint separator*  
*Universal hub/bearing puller*  
*Impact screwdriver*  
*Micrometer and/or vernier gauge*  
*Dial gauge*  
*Stroboscopic timing light*  
*Dwell angle meter/tachometer*  
*Universal electrical multi-meter*  
*Cylinder compression gauge*  
*Lifting tackle*  
*Trolley jack*  
*Light with extension lead*

### Buying tools

For practically all tools, a tool factor is the best source since he will have a very comprehensive range compared with the average garage or accessory shop. Having said that, accessory shops often offer excellent quality tools at discount prices, so it pays to shop around.

Remember, you don't have to buy the most expensive items on the shelf, but it is always advisable to steer clear of the very cheap tools. There are plenty of good tools around at reasonable prices, so ask the proprietor or manager of the shop for advice before making a purchase.

### Care and maintenance of tools

Having purchased a reasonable tool kit, it is necessary to keep the tools in a clean serviceable condition. After use, always wipe off any dirt, grease and metal particles using a clean, dry cloth, before putting the tools away. Never leave them lying around after they have been used. A simple tool rack on the garage or workshop wall, for items such as screwdrivers and pliers is a good idea. Store all normal wrenches and sockets in a metal box. Any measuring instruments, gauges, meters, etc. must be carefully stored where they cannot be damaged or become rusty.

Take a little care when tools are used. Hammer heads inevitably become marked and screwdrivers lose the keen edge on their blades from time to time. A little timely attention with emery cloth or a file will soon restore items like this to a good serviceable finish.

### Working facilities

Not to be forgotten when discussing tools, is the workshop itself. If anything more than routine maintenance is to be carried out, some form of suitable working area becomes essential.

It is appreciated that many an owner mechanic is forced by circumstances to remove an engine or similar item, without the benefit of a garage or workshop. Having done this, any repairs should always be done under the cover of a roof.

Wherever possible, any dismantling should be done on a clean, flat workbench or table at a suitable working height.

Any workbench needs a vice: one with a jaw opening of 4 in (100 mm) is suitable for most jobs. As mentioned previously, some clean dry storage space is also required for tools, as well as for lubricants, cleaning fluids, touch-up paints and so on, which become necessary.

Another item which may be required, and which has a much more general usage, is an electric drill with a chuck capacity of at least 5/8 in (8 mm). This, together with a good range of twist drills, is virtually essential for fitting accessories such as mirrors and reversing lights.

Last, but not least, always keep a supply of old newspapers and clean, lint-free rags available, and try to keep any working area as clean as possible.

### Spanner jaw gap comparison table

Jaw gap (in)	Spanner size
0.250	1/4 in AF
0.276	7 mm
0.313	5/16 in AF
0.315	8 mm
0.344	11/32 in AF; 1/8 in Whitworth
0.354	9 mm
0.375	3/8 in AF
0.394	10 mm
0.433	11 mm
0.438	7/16 in AF
0.445	3/16 in Whitworth; 1/4 in BSF
0.472	12 mm
0.500	1/2 in AF
0.512	13 mm
0.525	1/4 in Whitworth; 5/16 in BSF
0.551	14 mm
0.563	9/16 in AF
0.591	15 mm
0.600	5/16 in Whitworth; 3/8 in BSF
0.625	5/8 in AF
0.630	16 mm
0.669	17 mm
0.686	11/16 in AF
0.709	18 mm
0.710	3/8 in Whitworth; 7/16 in BSF
0.748	19 mm
0.750	3/4 in AF
0.813	13/16 in AF
0.820	7/16 in Whitworth; 1/2 in BSF
0.866	22 mm
0.875	7/8 in AF
0.920	1/2 in Whitworth; 9/16 in BSF
0.938	15/16 in AF
0.945	24 mm
1.000	1 in AF
1.010	9/16 in Whitworth; 5/8 in BSF
1.024	26 mm
1.063	11/16 in AF; 27 mm
1.100	5/8 in Whitworth; 11/16 in BSF
1.125	11/8 in AF
1.181	30 mm
1.200	11/16 in Whitworth; 3/4 in BSF
1.250	11/4 in AF
1.260	32 mm
1.300	3/4 in Whitworth; 7/8 in BSF
1.313	15/16 in AF
1.390	13/16 in Whitworth; 15/16 in BSF
1.417	36 mm
1.438	17/16 in AF
1.480	7/8 in Whitworth; 1 in BSF
1.500	11/2 in AF
1.575	40 mm; 15/16 in Whitworth
1.614	41 mm
1.625	15/8 in AF
1.670	1 in Whitworth; 11/8 in BSF
1.688	111/16 in AF
1.811	46 mm
1.813	113/16 in AF
1.860	11/8 in Whitworth; 11/4 in BSF
1.875	17/8 in AF
1.969	50 mm
2.000	2 in AF
2.050	11/4 in Whitworth; 13/8 in BSF
2.165	55 mm
2.362	60 mm

# Conversion factors

## Length (distance)

Inches (in)	X	25.4	=	Millimetres (mm)	X	0.0394	=	Inches (in)
Feet (ft)	X	0.305	=	Metres (m)	X	3.281	=	Feet (ft)
Miles	X	1.609	=	Kilometres (km)	X	0.621	=	Miles

## Volume (capacity)

Cubic inches (cu in; in <sup>3</sup> )	X	16.387	=	Cubic centimetres (cc; cm <sup>3</sup> )	X	0.061	=	Cubic inches (cu in; in <sup>3</sup> )
Imperial pints (Imp pt)	X	0.568	=	Litres (l)	X	1.76	=	Imperial pints (Imp pt)
Imperial quarts (Imp qt)	X	1.137	=	Litres (l)	X	0.88	=	Imperial quarts (Imp qt)
Imperial quarts (Imp qt)	X	1.201	=	US quarts (US qt)	X	0.833	=	Imperial quarts (Imp qt)
US quarts (US qt)	X	0.946	=	Litres (l)	X	1.057	=	US quarts (US qt)
Imperial gallons (Imp gal)	X	4.546	=	Litres (l)	X	0.22	=	Imperial gallons (Imp gal)
Imperial gallons (Imp gal)	X	1.201	=	US gallons (US gal)	X	0.833	=	Imperial gallons (Imp gal)
US gallons (US gal)	X	3.785	=	Litres (l)	X	0.264	=	US gallons (US gal)

## Mass (weight)

Ounces (oz)	X	28.35	=	Grams (g)	X	0.035	=	Ounces (oz)
Pounds (lb)	X	0.454	=	Kilograms (kg)	X	2.205	=	Pounds (lb)

## Force

Ounces-force (ozf; oz)	X	0.278	=	Newtons (N)	X	3.6	=	Ounces-force (ozf; oz)
Pounds-force (lbf; lb)	X	4.448	=	Newtons (N)	X	0.225	=	Pounds-force (lbf; lb)
Newtons (N)	X	0.1	=	Kilograms-force (kgf; kg)	X	9.81	=	Newtons (N)

## Pressure

Pounds-force per square inch (psi; lbf/in <sup>2</sup> ; lb/in <sup>2</sup> )	X	0.070	=	Kilograms-force per square centimetre (kgf/cm <sup>2</sup> ; kg/cm <sup>2</sup> )	X	14.223	=	Pounds-force per square inch (psi; lbf/in <sup>2</sup> ; lb/in <sup>2</sup> )
Pounds-force per square inch (psi; lbf/in <sup>2</sup> ; lb/in <sup>2</sup> )	X	0.068	=	Atmospheres (atm)	X	14.696	=	Pounds-force per square inch (psi; lbf/in <sup>2</sup> ; lb/in <sup>2</sup> )
Pounds-force per square inch (psi; lbf/in <sup>2</sup> ; lb/in <sup>2</sup> )	X	0.069	=	Bars	X	14.5	=	Pounds-force per square inch (psi; lbf/in <sup>2</sup> ; lb/in <sup>2</sup> )
Pounds-force per square inch (psi; lbf/in <sup>2</sup> ; lb/in <sup>2</sup> )	X	6.895	=	Kilopascals (kPa)	X	0.145	=	Pounds-force per square inch (psi; lbf/in <sup>2</sup> ; lb/in <sup>2</sup> )
Kilopascals (kPa)	X	0.01	=	Kilograms-force per square centimetre (kgf/cm <sup>2</sup> ; kg/cm <sup>2</sup> )	X	98.1	=	Kilopascals (kPa)
Millibar (mbar)	X	100	=	Pascals (Pa)	X	0.01	=	Millibar (mbar)
Millibar (mbar)	X	0.0145	=	Pounds-force per square inch (psi; lbf/in <sup>2</sup> ; lb/in <sup>2</sup> )	X	68.947	=	Millibar (mbar)
Millibar (mbar)	X	0.75	=	Millimetres of mercury (mmHg)	X	1.333	=	Millibar (mbar)
Millibar (mbar)	X	0.401	=	Inches of water (inH <sub>2</sub> O)	X	2.491	=	Millibar (mbar)
Millimetres of mercury (mmHg)	X	0.535	=	Inches of water (inH <sub>2</sub> O)	X	1.868	=	Millimetres of mercury (mmHg)
Inches of water (inH <sub>2</sub> O)	X	0.036	=	Pounds-force per square inch (psi; lbf/in <sup>2</sup> ; lb/in <sup>2</sup> )	X	27.68	=	Inches of water (inH <sub>2</sub> O)

## Torque (moment of force)

Pounds-force inches (lbf in; lb in)	X	1.152	=	Kilograms-force centimetre (kgf cm; kg cm)	X	0.868	=	Pounds-force inches (lbf in; lb in)
Pounds-force inches (lbf in; lb in)	X	0.113	=	Newton metres (Nm)	X	8.85	=	Pounds-force inches (lbf in; lb in)
Pounds-force inches (lbf in; lb in)	X	0.083	=	Pounds-force feet (lbf ft; lb ft)	X	12	=	Pounds-force inches (lbf in; lb in)
Pounds-force feet (lbf ft; lb ft)	X	0.138	=	Kilograms-force metres (kgf m; kg m)	X	7.233	=	Pounds-force feet (lbf ft; lb ft)
Pounds-force feet (lbf ft; lb ft)	X	1.356	=	Newton metres (Nm)	X	0.738	=	Pounds-force feet (lbf ft; lb ft)
Newton metres (Nm)	X	0.102	=	Kilograms-force metres (kgf m; kg m)	X	9.804	=	Newton metres (Nm)

## Power

Horsepower (hp)	X	745.7	=	Watts (W)	X	0.0013	=	Horsepower (hp)
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## Velocity (speed)

Miles per hour (miles/hr; mph)	X	1.609	=	Kilometres per hour (km/hr; kph)	X	0.621	=	Miles per hour (miles/hr; mph)
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## Fuel consumption\*

Miles per gallon, Imperial (mpg)	X	0.354	=	Kilometres per litre (km/l)	X	2.825	=	Miles per gallon, Imperial (mpg)
Miles per gallon, US (mpg)	X	0.425	=	Kilometres per litre (km/l)	X	2.352	=	Miles per gallon, US (mpg)

## Temperature

Degrees Fahrenheit = (°C x 1.8) + 32

Degrees Celsius (Degrees Centigrade; °C) = (°F - 32) x 0.56

\*It is common practice to convert from miles per gallon (mpg) to litres/100 kilometres (l/100km), where mpg (Imperial) x l/100 km = 282 and mpg (US) x l/100 km = 235

# Safety first!

Professional motor mechanics are trained in safe working procedures. However enthusiastic you may be about getting on with the job in hand, do take the time to ensure that your safety is not put at risk. A moment's lack of attention can result in an accident, as can failure to observe certain elementary precautions.

There will always be new ways of having accidents, and the following points do not pretend to be a comprehensive list of all dangers; they are intended rather to make you aware of the risks and to encourage a safety-conscious approach to all work you carry out on your vehicle.

## Essential DOs and DON'Ts

**DON'T** rely on a single jack when working underneath the vehicle. Always use reliable additional means of support, such as axle stands, securely placed under a part of the vehicle that you know will not give way.

**DON'T** attempt to loosen or tighten high-torque nuts (e.g. wheel hub nuts) while the vehicle is on a jack; it may be pulled off.

**DON'T** start the engine without first ascertaining that the transmission is in neutral (or 'Park' where applicable) and the parking brake applied.

**DON'T** suddenly remove the filler cap from a hot cooling system – cover it with a cloth and release the pressure gradually first, or you may get scalded by escaping coolant.

**DON'T** attempt to drain oil until you are sure it has cooled sufficiently to avoid scalding you.

**DON'T** grasp any part of the engine, exhaust or catalytic converter without first ascertaining that it is sufficiently cool to avoid burning you.

**DON'T** allow brake fluid or antifreeze to contact vehicle paintwork.

**DON'T** syphon toxic liquids such as fuel, brake fluid or antifreeze by mouth, or allow them to remain on your skin.

**DON'T** inhale dust – it may be injurious to health (see *Asbestos* below).

**DON'T** allow any spilt oil or grease to remain on the floor – wipe it up straight away, before someone slips on it.

**DON'T** use ill-fitting spanners or other tools which may slip and cause injury.

**DON'T** attempt to lift a heavy component which may be beyond your capability – get assistance.

**DON'T** rush to finish a job, or take unverified short cuts.

**DON'T** allow children or animals in or around an unattended vehicle.

**DO** wear eye protection when using power tools such as drill, sander, bench grinder etc, and when working under the vehicle.

**DO** use a barrier cream on your hands prior to undertaking dirty jobs – it will protect your skin from infection as well as making the dirt easier to remove afterwards; but make sure your hands aren't left slippery. Note that long-term contact with used engine oil can be a health hazard.

**DO** keep loose clothing (cuffs, tie etc) and long hair well out of the way of moving mechanical parts.

**DO** remove rings, wristwatch etc, before working on the vehicle – especially the electrical system.

**DO** ensure that any lifting tackle used has a safe working load rating adequate for the job.

**DO** keep your work area tidy – it is only too easy to fall over articles left lying around.

**DO** get someone to check periodically that all is well, when working alone on the vehicle.

**DO** carry out work in a logical sequence and check that everything is correctly assembled and tightened afterwards.

**DO** remember that your vehicle's safety affects that of yourself and others. If in doubt on any point, get specialist advice.

**IF**, in spite of following these precautions, you are unfortunate enough to injure yourself, seek medical attention as soon as possible.

## Asbestos

Certain friction, insulating, sealing, and other products – such as brake linings, brake bands, clutch linings, torque converters, gaskets, etc – contain asbestos. *Extreme care must be taken to avoid inhalation of dust from such products since it is hazardous to health.* If in doubt, assume that they *do* contain asbestos.

## Fire

Remember at all times that petrol (gasoline) is highly flammable. Never smoke, or have any kind of naked flame around, when working on the vehicle. But the risk does not end there – a spark caused by an electrical short-circuit, by two metal surfaces contacting each other, by careless use of tools, or even by static electricity built up in your body under certain conditions, can ignite petrol vapour, which in a confined space is highly explosive.

Always disconnect the battery earth (ground) terminal before working on any part of the fuel or electrical system, and never risk spilling fuel on to a hot engine or exhaust.

It is recommended that a fire extinguisher of a type suitable for fuel and electrical fires is kept handy in the garage or workplace at all times. Never try to extinguish a fuel or electrical fire with water.

## Fumes

Certain fumes are highly toxic and can quickly cause unconsciousness and even death if inhaled to any extent. Petrol (gasoline) vapour comes into this category, as do the vapours from certain solvents such as trichloroethylene. Any draining or pouring of such volatile fluids should be done in a well ventilated area.

When using cleaning fluids and solvents, read the instructions carefully. Never use materials from unmarked containers – they may give off poisonous vapours.

Never run the engine of a motor vehicle in an enclosed space such as a garage. Exhaust fumes contain carbon monoxide which is extremely poisonous; if you need to run the engine, always do so in the open air or at least have the rear of the vehicle outside the workplace.

If you are fortunate enough to have the use of an inspection pit, never drain or pour petrol, and never run the engine, while the vehicle is standing over it; the fumes, being heavier than air, will concentrate in the pit with possibly lethal results.

## The battery

Never cause a spark, or allow a naked light, near the vehicle's battery. It will normally be giving off a certain amount of hydrogen gas, which is highly explosive.

Always disconnect the battery earth (ground) terminal before working on the fuel or electrical systems.

If possible, loosen the filler plugs or cover when charging the battery from an external source. Do not charge at an excessive rate or the battery may burst.

Take care when topping up and when carrying the battery. The acid electrolyte, even when diluted, is very corrosive and should not be allowed to contact the eyes or skin.

If you ever need to prepare electrolyte yourself, always add the acid slowly to the water, and never the other way round. Protect against splashes by wearing rubber gloves and goggles.

When jump starting a car using a booster battery, for negative earth (ground) vehicles, connect the jump leads in the following sequence: First connect one jump lead between the positive (+) terminals of the two batteries. Then connect the other jump lead first to the negative (-) terminal of the booster battery, and then to a good earthing (ground) point on the vehicle to be started, at least 18 in (45 cm) from the battery if possible. Ensure that hands and jump leads are clear of any moving parts, and that the two vehicles do not touch. Disconnect the leads in the reverse order.

## Mains electricity

When using an electric power tool, inspection light etc, which works from the mains, always ensure that the appliance is correctly connected to its plug and that, where necessary, it is properly earthed (grounded). Do not use such appliances in damp conditions and, again, beware of creating a spark or applying excessive heat in the vicinity of fuel or fuel vapour.

## Ignition HT voltage

A severe electric shock can result from touching certain parts of the ignition system, such as the HT leads, when the engine is running or being cranked, particularly if components are damp or the insulation is defective. Where an electronic ignition system is fitted, the HT voltage is much higher and could prove fatal.

# Routine maintenance

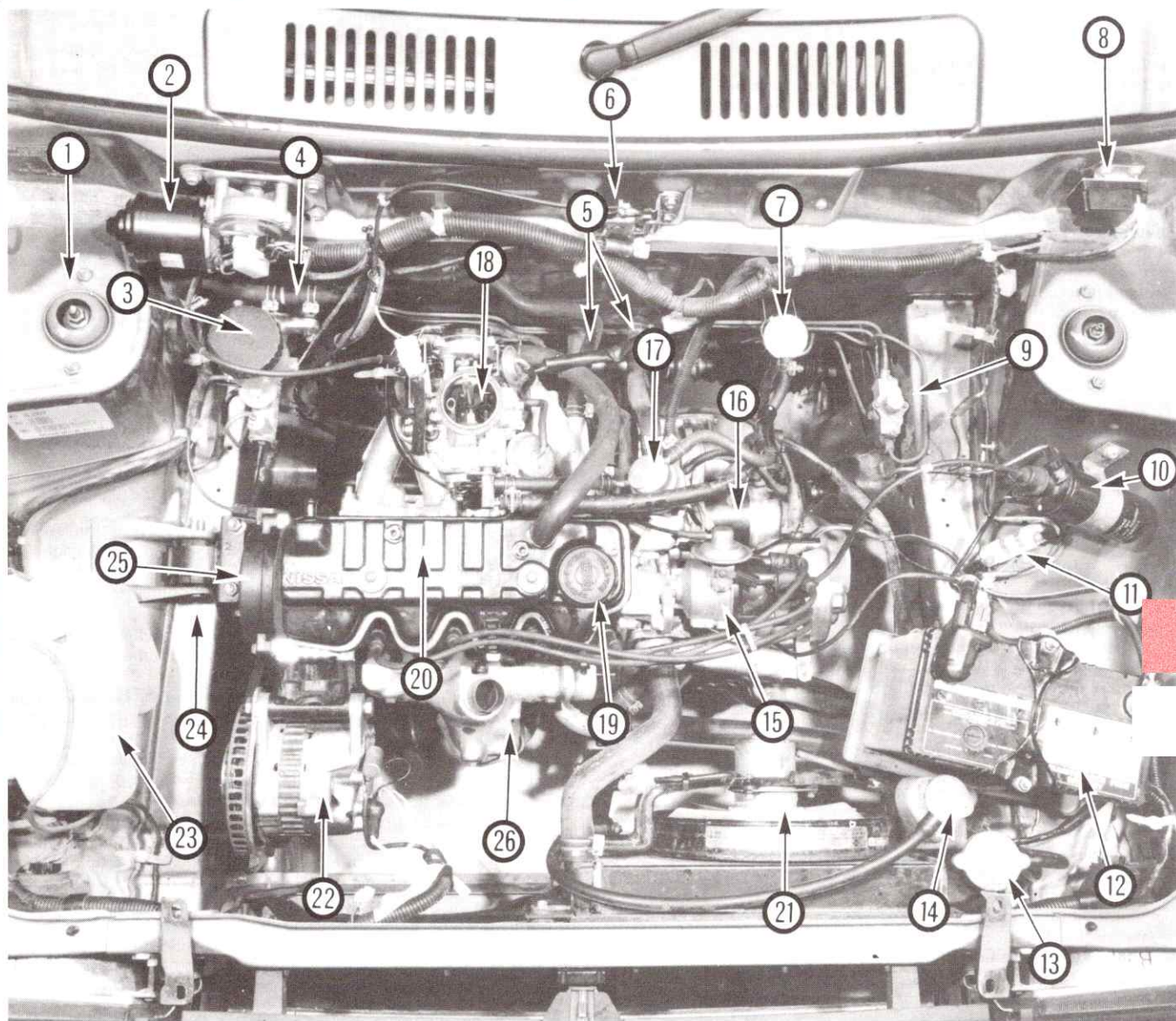
*For modifications, and information applicable to later models, see Supplement at end of manual*

The routine maintenance instructions given here are basically those recommended by the manufacturer. They are sometimes supplemented by additional tasks, which have proved to be necessary.

The maintenance intervals recommended are those given by the manufacturer. They are necessarily a compromise, since no two vehicles operate under identical circumstances or conditions. The DIY mechanic, who does not have repair costs to take in to consideration

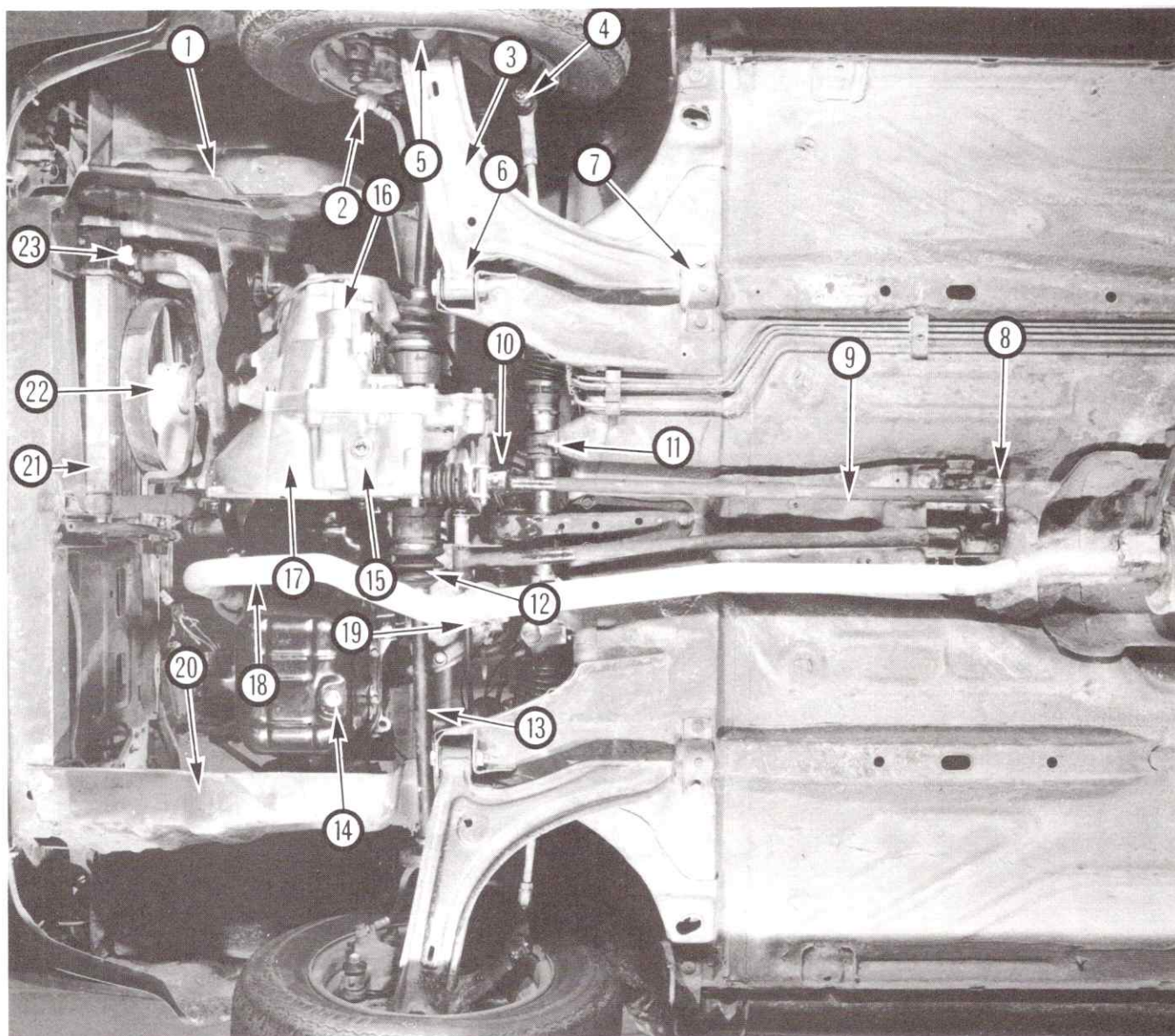
may wish to shorten the specified intervals. Experience will show if this is necessary.

Where vehicles are used under severe operating conditions such as extremes of temperature, dusty conditions or mainly stop start driving, then the oil should be changed more frequently, if in doubt consult your dealer.



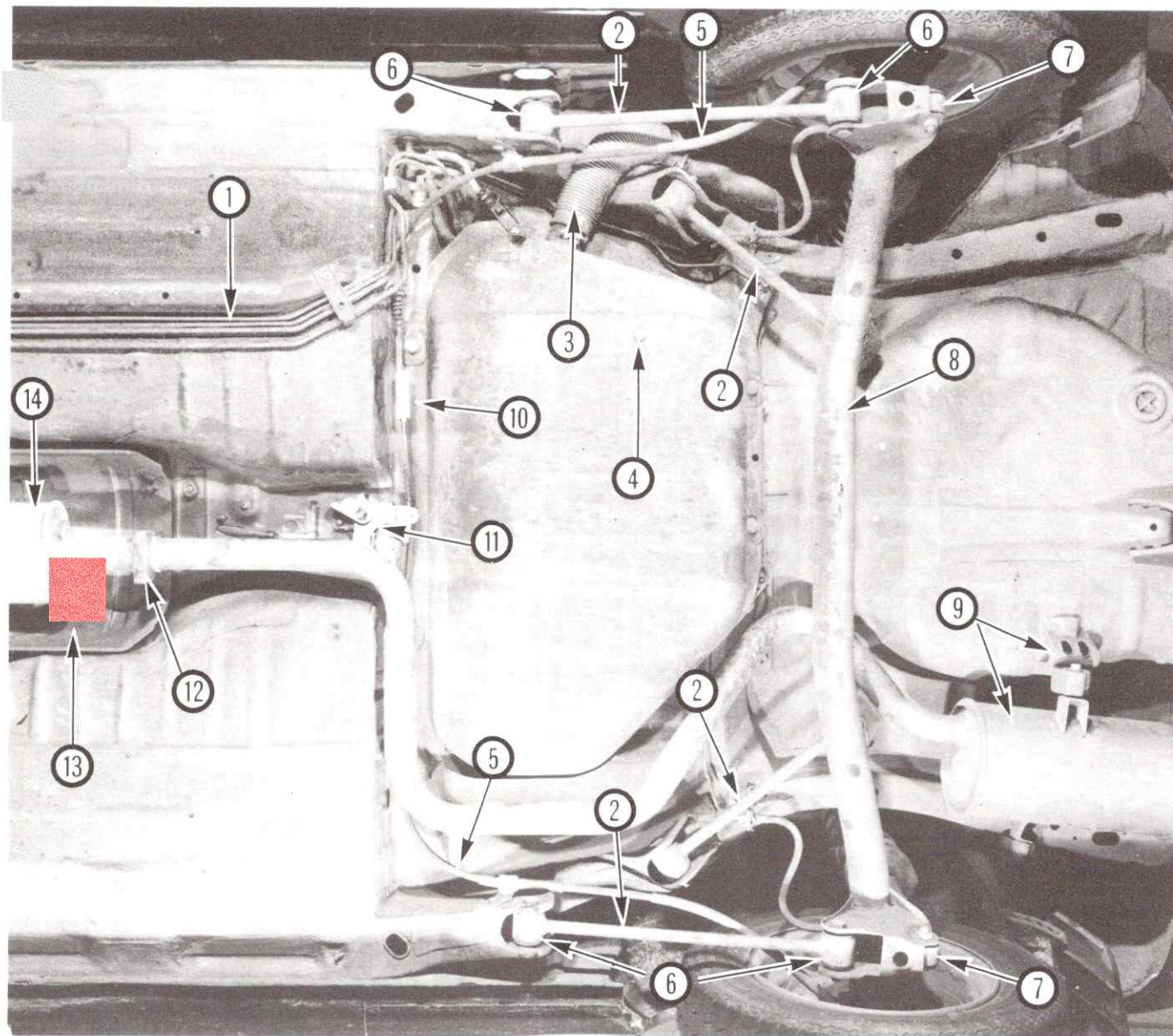
Engine compartment (air cleaner removed)

- |   |  |                                     |   |
|---|--|-------------------------------------|---|
| 1 Shock absorber top mounting               | 6 Bonnet release catch mechanism       | 11 Ignition system ballast resistor | 19 Engine oil filler cap                |
| 2 Windscreen wiper motor assembly           | 7 Fuel filter                          | 12 Battery                          | 20 Rocker cover                         |
| 3 Brake master cylinder fluid reservoir cap | 8 Intermittent wipe relay amplifier    | 13 Radiator filler cap              | 21 Radiator cooling fan                 |
| 4 Brake vacuum servo hose to inlet manifold | 9 Brake system dual proportioner valve | 14 Radiator expansion bottle        | 22 Alternator                           |
| 5 Heater hoses (inlet and outlet)           | 10 Ignition coil                       | 15 Distributor                      | 23 Windscreen wash reservoir            |
|   |  | 16 Starter motor                    | 24 Engine mounting                      |
|   |  | 17 Fuel pump                        | 25 Timing cover                         |
|   |  | 18 Carburettor                      | 26 Exhaust manifold and collector plate |



View of front underside of car

- |                                  |  |                                 |                                |
|----------------------------------|--|---------------------------------|--------------------------------|
| 1 Engine shield                  | 7 Transverse link rear mounting  | 11 Steering rack assembly       | 18 Exhaust downpipe            |
| 2 Brake caliper and hose         | 8 Gear change lever connection   | 12 Inboard driveshaft joint     | 19 Exhaust pipe front mounting |
| 3 Suspension transverse link     | 9 Gear change control rod  | 13 Driveshaft                   | 20 Engine shield               |
| 4 Steering rod balljoint         | 10 Gear change control rod to transmission unit input shaft connection | 14 Engine oil drain plug        | 21 Radiator                    |
| 5 Transverse link balljoint      |  | 15 Transmission unit drain plug | 22 Radiator cooling fan        |
| 6 Transverse link front mounting |  | 16 Transmission unit            | 23 Radiator drain plug         |
|                                  |  | 17 Clutch bellhousing           |                                |



View of rear underside of car

- |                                      |                                      |                                     |                                  |
|--------------------------------------|--------------------------------------|-------------------------------------|----------------------------------|
| 1 Fuel and hydraulic brake pipes     | 5 Handbrake cable                    | 9 Exhaust silencer and mounting     | 12 Intermediate exhaust mounting |
| 2 Rear suspension location link rods | 6 Link rod attachment brackets       | 10 Handbrake cable adjustment point | 13 Heat shield                   |
| 3 Fuel tank filler pipe              | 7 Rear shock absorber lower mounting | 11 Handbrake cable pivot arm        | 14 Intermediate silencer         |
| 4 Fuel tank drain plug               | 8 Rear axle tube                     |                                     |                                  |

**Weekly or before a long journey**

- Check engine oil level (Chapter 1, Sec 2)
- Check engine coolant level (Chapter 2, Sec 3)
- Check automatic transmission fluid level (Chapter 7, Sec 3)
- Check brake fluid level (Chapter 9, Sec 2)
- Check all tyres for condition and pressure (including spare) (Chapter 10, Sec 22)
- Check operation of all lights, horn, wipers and washers (Chapter 12)
- Check washer fluid level (Chapter 12, Sec 23)

**Every 6000 miles (10 000 km) or 6 months – whichever comes first**

- Renew engine oil and filter (Chapter 1, Secs 2 and 10)
- Check engine idle speed (Chapter 3, Sec 10)
- Check distributor contact breaker points (Chapter 4, Sec 3)
- Check ignition timing (Chapter 4, Sec 8)
- Check spark plugs (Chapter 4, Sec 10)
- Check manual transmission oil level (Chapter 6, Sec 2)
- Check disc brake pads (Chapter 9, Sec 2)
- Check power steering fluid level (Chapter 10, Sec 2)
- Check brake, fuel and exhaust systems for leaks, cracks, chafing, deterioration and security
- Lubricate locks, hinges and latches
- Check operation of brakes (including handbrake) and clutch (Chapters 5 and 9)

**Every 12 000 miles (20 000 km) or 12 months – whichever comes first**

- In addition to the 6000 mile service*
- Check valve clearances (Chapter 1, Sec 5)
  - Check positive crankcase ventilation system (Chapter 1, Sec 24)
  - Check cooling system hoses and connections (Chapter 2, Sec 2)
  - Check all drivebelts for cracks, fraying, wear and tension (Chapter 2, Sec 9)
  - Renew distributor contact breaker points (Chapter 4, Sec 3)
  - Renew spark plugs (Chapter 4, Sec 10)
  - Check steering gear and linkage, suspension and driveshafts for damage, security and lubrication (Chapters 8 and 10)
  - Check brake shoes and drums (Chapter 9, Sec 4)
  - Check wheels for alignment and balance (Chapter 10, Sec 21)

Check seat belts, buckles, retractors, anchor points and adjusters for wear and security (Chapter 11, Sec 25)

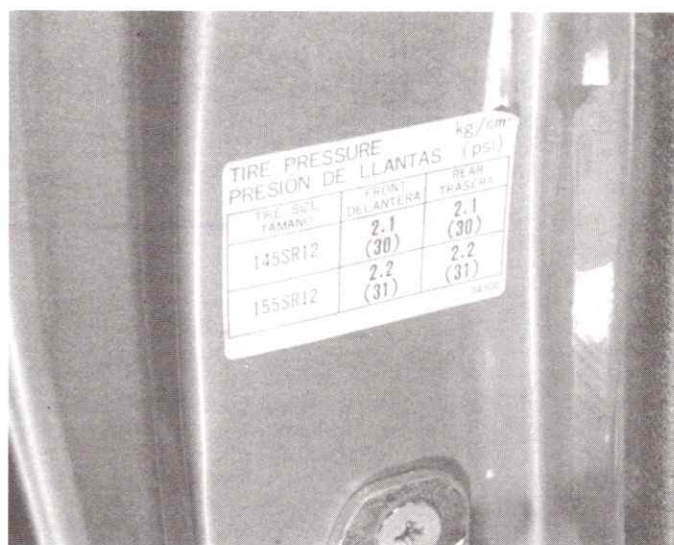
**Every 24 000 miles (40 000 km) or 24 months – whichever comes first**

*In addition to the 12 000 mile service*

- Renew engine coolant (Chapter 2, Secs 3 and 4)
- Renew air cleaner element (Chapter 3, Sec 3)
- Renew fuel filter and check all fuel lines and connections (Chapter 3, Sec 8)
- Check ignition wiring (Chapter 4, Sec 2)
- Renew brake fluid (Chapter 9, Sec 13)
- Check brake servo vacuum hoses, connections and non-return valve (Chapter 9, Sec 14)
- Check front wheel bearing grease (Chapter 10, Sec 5)

**Every 60 000 miles (100 000 km)**

- Renew the timing belt (Chapter 1, Sec 6)



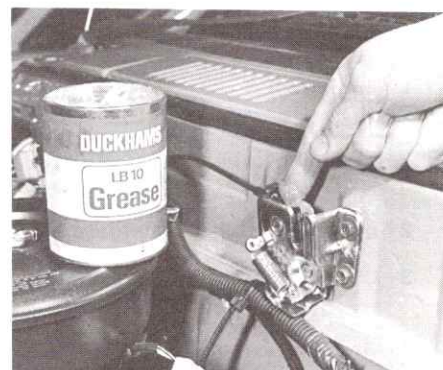
Tyre pressure plate



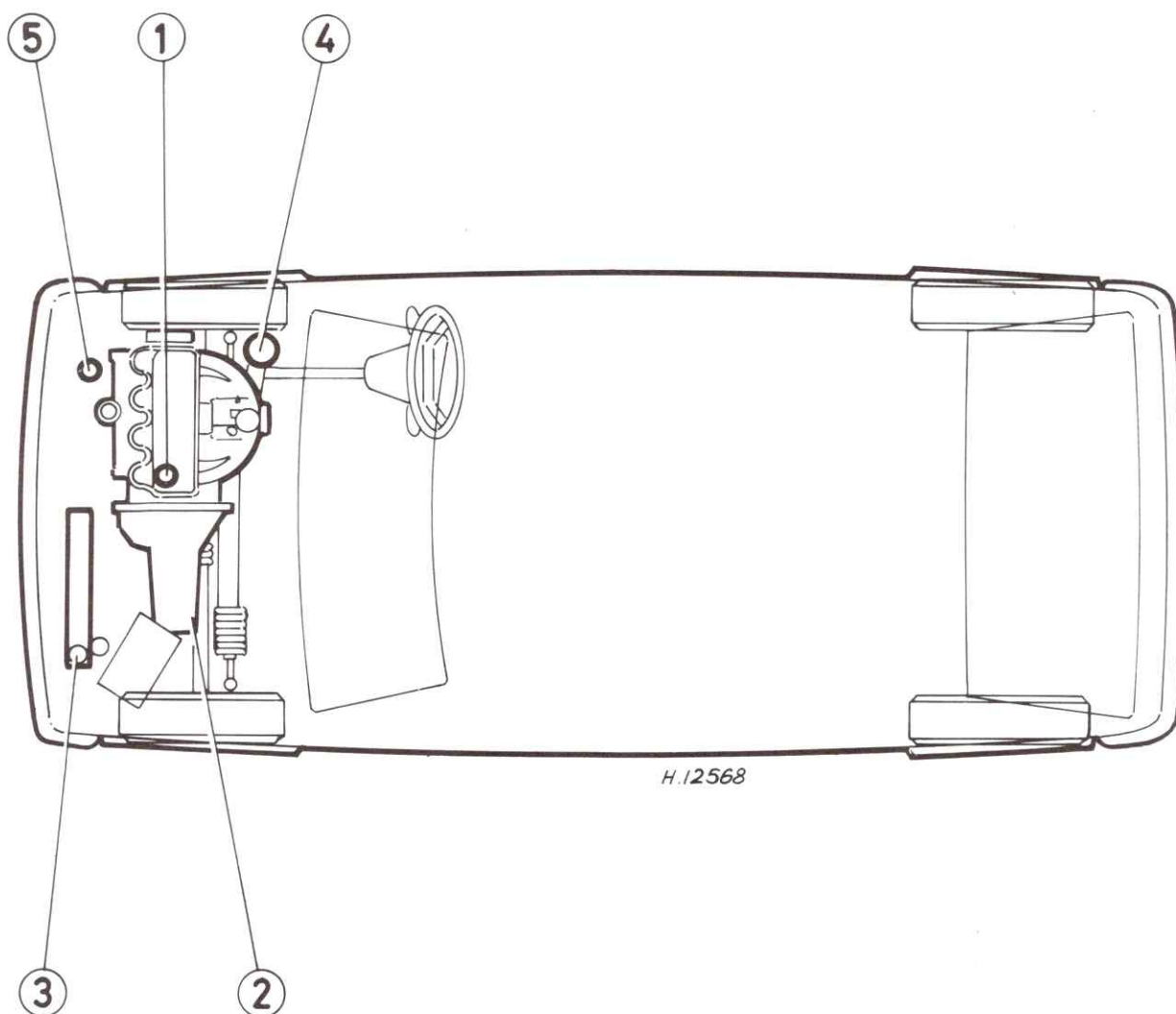
Topping-up the engine oil level



Topping-up the brake fluid level



Greasing the bonnet lock



## Recommended lubricants and fluids

Component or system	Lubricant type/specification	Duckhams recommendation
1 Engine	Multigrade engine oil, viscosity range SAE 10W/30 to 15W/50, to API SE or SF	Duckhams QXR, Hypergrade, or 10W/40 Motor Oil
2 Manual gearbox	Gear oil, viscosity SAE 80, to API GL4	Duckhams Hypoid 80
2 Automatic transmission	Dexron II type ATF	Duckhams D-Matic
3 Cooling system	Ethylene glycol based antifreeze	Duckhams Universal Antifreeze and Summer Coolant
4 Braking system	Hydraulic fluid to DOT 3	Duckhams Universal Brake and Clutch Fluid
5 Power assisted steering	Dexron II type ATF	Duckhams D-Matic
General purpose greasing	Lithium based grease to NLGI 2	Duckhams LB 10

# Fault diagnosis

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## Introduction

The vehicle owner who does his or her own maintenance according to the recommended schedules should not have to use this section of the manual very often. Modern component reliability is such that, provided those items subject to wear or deterioration are inspected or renewed at the specified intervals, sudden failure is comparatively rare. Faults do not usually just happen as a result of sudden failure, but develop over a period of time. Major mechanical failures in particular are usually preceded by characteristic symptoms over hundreds or even thousands of miles. Those components which do occasionally fail without warning are often small and easily carried in the vehicle.

With any fault finding, the first step is to decide where to begin investigations. Sometimes this is obvious, but on other occasions a little detective work will be necessary. The owner who makes half a dozen haphazard adjustments or replacements may be successful in curing a fault (or its symptoms), but he will be none the wiser if the fault recurs and he may well have spent more time and money than was necessary. A calm and logical approach will be found to be more satisfactory in the long run. Always take into account any warning signs or abnormalities that may have been noticed in the period preceding the fault – power loss, high or low gauge readings, unusual noises or smells, etc – and remember that failure of components such as fuses or spark plugs may only be pointers to some underlying fault.

The pages which follow here are intended to help in cases of failure to start or breakdown on the road. There is also a Fault Diagnosis Section at the end of each Chapter which should be consulted if the preliminary checks prove unfruitful. Whatever the fault, certain basic principles apply. These are as follows:

**Verify the fault.** This is simply a matter of being sure that you know what the symptoms are before starting work. This is particularly important if you are investigating a fault for someone else who may not have described it very accurately.

**Don't overlook the obvious.** For example, if the vehicle won't start, is there petrol in the tank? (Don't take anyone else's word on this particular point, and don't trust the fuel gauge either!) If an electrical fault is indicated, look for loose or broken wires before digging out the test gear.

**Cure the disease, not the symptom.** Substituting a flat battery with a fully charged one will get you off the hard shoulder, but if the underlying cause is not attended to, the new battery will go the same way. Similarly, changing oil-fouled spark plugs for a new set will get you moving again, but remember that the reason for the fouling (if it

wasn't simply an incorrect grade of plug) will have to be established and corrected.

**Don't take anything for granted.** Particularly, don't forget that a 'new' component may itself be defective (especially if it's been rattling round in the boot for months), and don't leave components out of a fault diagnosis sequence just because they are new or recently fitted. When you do finally diagnose a difficult fault, you'll probably realise that all the evidence was there from the start.

## Electrical faults

Electrical faults can be more puzzling than straightforward mechanical failures, but they are no less susceptible to logical analysis if the basic principles of operation are understood. Vehicle electrical wiring exists in extremely unfavourable conditions – heat, vibration and chemical attack – and the first things to look for are loose or corroded connections and broken or chafed wires, especially where the wires pass through holes in the bodywork or are subject to vibration.

All metal-bodied vehicles in current production have one pole of the battery 'earthed', ie connected to the vehicle bodywork, and in nearly all modern vehicles it is the negative (–) terminal. The various electrical components – motors, bulb holders etc – are also connected to earth, either by means of a lead or directly by their mountings. Electric current flows through the component and then back to the battery via the bodywork. If the component mounting is loose or corroded, or if a good path back to the battery is not available, the circuit will be incomplete and malfunction will result. The engine and/or gearbox are also earthed by means of flexible metal straps to the body or subframe; if these straps are loose or missing, starter motor, generator and ignition trouble may result.

Assuming the earth return to be satisfactory, electrical faults will be due either to component malfunction or to defects in the current supply. Individual components are dealt with in Chapter 12. If supply wires are broken or cracked internally this results in an open-circuit, and the easiest way to check for this is to bypass the suspect wire temporarily with a length of wire having a crocodile clip or suitable connector at each end. Alternatively, a 12V test lamp can be used to verify the presence of supply voltage at various points along the wire and the break can be thus isolated.

If a bare portion of a live wire touches the bodywork or other earthed metal part, the electricity will take the low-resistance path thus formed back to the battery: this is known as a short-circuit. Hopefully a short-circuit will blow a fuse, but otherwise it may cause burning of the insulation (and possibly further short-circuits) or even a fire. This is why it is inadvisable to bypass persistently blowing fuses with silver foil or wire.

**Spares and tool kit**

Most vehicles are supplied only with sufficient tools for wheel changing; the *Maintenance and minor repair* tool kit detailed in *Tools and working facilities*, with the addition of a hammer, is probably sufficient for those repairs that most motorists would consider attempting at the roadside. In addition a few items which can be fitted without too much trouble in the event of a breakdown should be carried. Experience and available space will modify the list below, but the following may save having to call on professional assistance:

*Spark plugs, clean and correctly gapped*

*HT lead and plug cap – long enough to reach the plug furthest from the distributor*

*Distributor rotor, condenser and contact breaker points*

*Drivebelt(s) – emergency type may suffice*

*Spare fuses*

*Set of principal light bulbs*

*Tin of radiator sealer and hose bandage*

*Exhaust bandage*

*Roll of insulating tape*

*Length of soft iron wire*

*Length of electrical flex*

*Torch or inspection lamp (can double as test lamp)*

*Battery jump leads*

*Tow-rope*

*Ignition waterproofing aerosol*

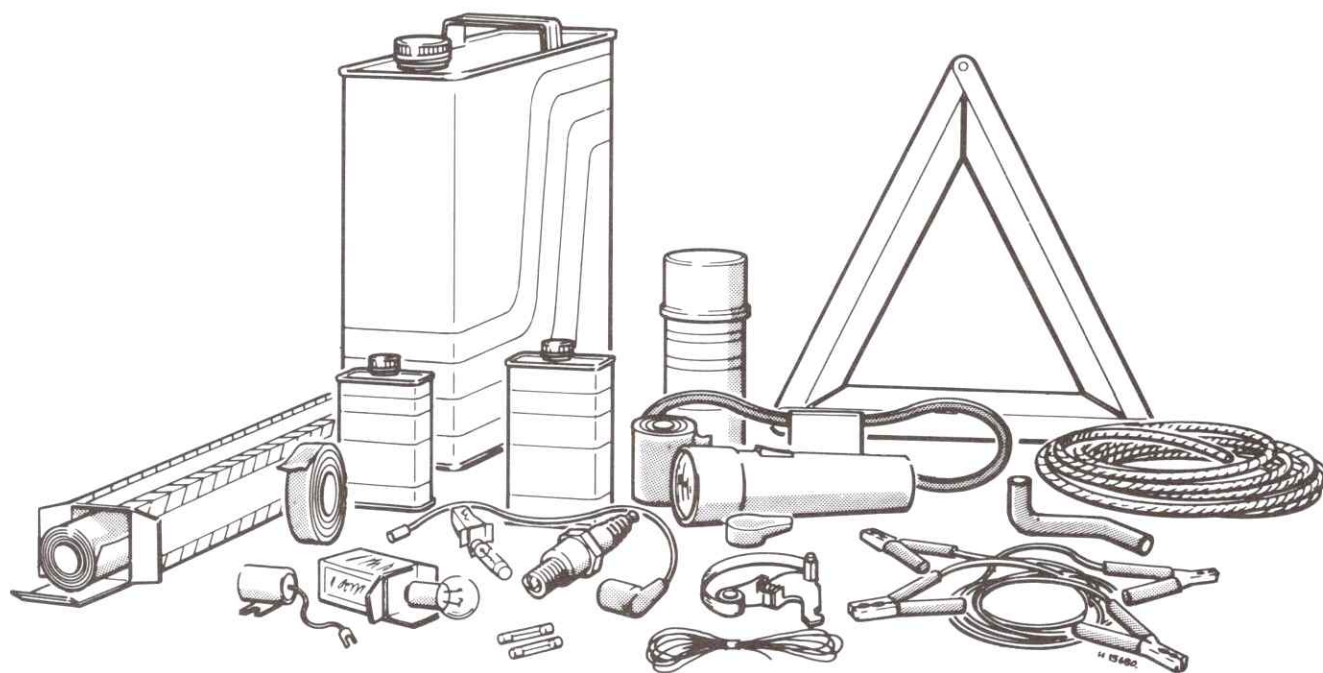
*Litre of engine oil*

*Sealed can of hydraulic fluid*

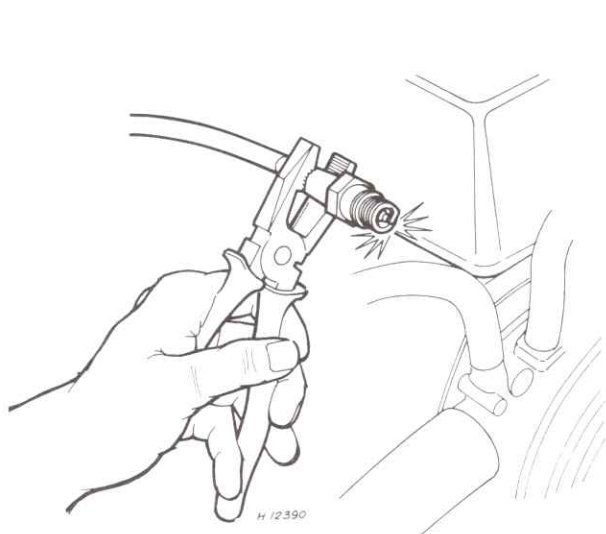
*Emergency windscreen*

*'Jubilee' clips*

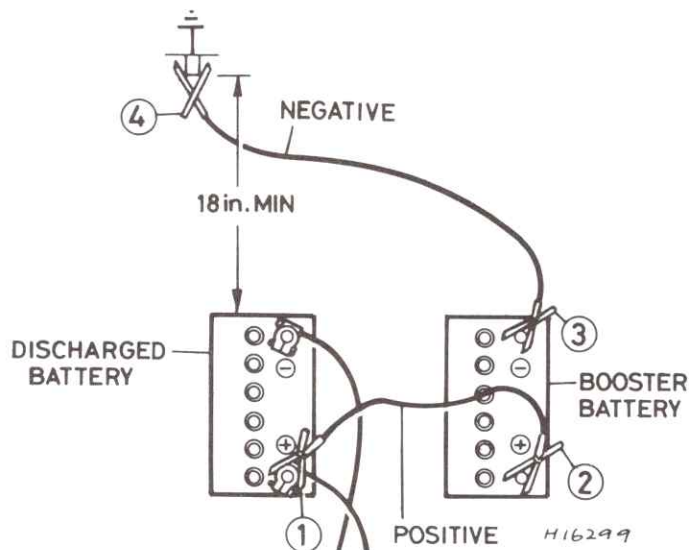
*Tube of filler paste*



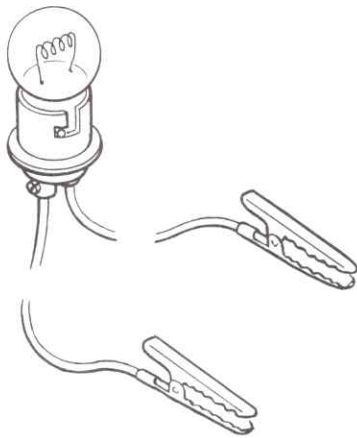
Carrying a few spares may save you a long walk!



Crank engine and check for spark. Note use of insulated tool to hold plug lead



Jump start lead connections for negative earth – connect leads in order shown



A simple test lamp is useful for checking electrical faults

If spare fuel is carried, a can designed for the purpose should be used to minimise risks of leakage and collision damage. A first aid kit and a warning triangle, whilst not at present compulsory in the UK, are obviously sensible items to carry in addition to the above.

When touring abroad it may be advisable to carry additional spares which, even if you cannot fit them yourself, could save having to wait while parts are obtained. The items below may be worth considering:

*Clutch and throttle cables*  
*Cylinder head gasket*  
*Alternator brushes*  
*Fuel pump repair kit*  
*Tyre valve core*

One of the motoring organisations will be able to advise on availability of fuel etc in foreign countries.

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### Engine will not start

---

#### *Engine fails to turn when starter operated*

Flat battery (recharge, use jump leads, or push start)  
 Battery terminals loose or corroded  
 Battery earth to body defective  
 Engine earth strap loose or broken  
 Starter motor (or solenoid) wiring loose or broken  
 Automatic transmission selector in wrong position, or inhibitor switch faulty  
 Ignition/starter switch faulty  
 Major mechanical failure (seizure)  
 Starter or solenoid internal fault (see Chapter 12)

#### *Starter motor turns engine slowly*

Partially discharged battery (recharge, use jump leads, or push start)  
 Battery terminals loose or corroded  
 Battery earth to body defective  
 Engine earth strap loose  
 Starter motor (or solenoid) wiring loose  
 Starter motor internal fault (see Chapter 12)

#### *Starter motor spins without turning engine*

Flat battery  
 Starter motor pinion sticking on sleeve  
 Flywheel gear teeth damaged or worn  
 Starter motor mounting bolts loose

#### *Engine turns normally but fails to start*

Damp or dirty HT leads and distributor cap (crank engine and check for spark)  
 Dirty or incorrectly gapped distributor points (if applicable)  
 No fuel in tank (check for delivery at carburettor)

Excessive choke (hot engine) or insufficient choke (cold engine)  
 Fouled or incorrectly gapped spark plugs (remove, clean and regap)  
 Other ignition system fault (see Chapter 4)  
 Other fuel system fault (see Chapter 3)  
 Poor compression (see Chapter 1)  
 Major mechanical failure (eg camshaft drive)

#### *Engine fires but will not run*

Insufficient choke (cold engine)  
 Air leaks at carburettor or inlet manifold  
 Fuel starvation (see Chapter 3)  
 Ballast resistor defective, or other ignition fault (see Chapter 4)

---

### Engine cuts out and will not restart

---

#### *Engine cuts out suddenly – ignition fault*

Loose or disconnected LT wires  
 Wet HT leads or distributor cap (after traversing water splash)  
 Coil or condenser failure (check for spark)  
 Other ignition fault (see Chapter 4)

#### *Engine misfires before cutting out – fuel fault*

Fuel tank empty  
 Fuel pump defective or filter blocked (check for delivery)  
 Fuel tank filler vent blocked (suction will be evident on releasing cap)  
 Carburettor needle valve sticking  
 Carburettor jets blocked (fuel contaminated)  
 Other fuel system fault (see Chapter 3)

#### *Engine cuts out – other causes*

Serious overheating  
 Major mechanical failure (eg camshaft drive)

---

### Engine overheats

---

#### *Ignition (no-charge) warning light illuminated*

Slack or broken drivebelt – retension or renew (Chapter 2)

#### *Ignition warning light not illuminated*

Coolant loss due to internal or external leakage (see Chapter 2)  
 Thermostat defective  
 Low oil level  
 Brakes binding  
 Radiator clogged externally or internally  
 Electric cooling fan not operating correctly  
 Engine waterways clogged  
 Ignition timing incorrect or automatic advance malfunctioning  
 Mixture too weak

**Note:** Do not add cold water to an overheated engine or damage may result

---

### Low engine oil pressure

---

#### *Gauge reads low or warning light illuminated with engine running*

Oil level low or incorrect grade  
 Defective gauge or sender unit  
 Wire to sender unit earthed  
 Engine overheating  
 Oil filter clogged or bypass valve defective  
 Oil pressure relief valve defective  
 Oil pick-up strainer clogged  
 Oil pump worn or mountings loose  
 Worn main or big-end bearings

**Note:** Low oil pressure in a high-mileage engine at tickover is not necessarily a cause for concern. Sudden pressure loss at speed is far more significant. In any event, check the gauge or warning light sender before condemning the engine.

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**Engine noises**

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*Pre-ignition (pink) on acceleration*

- Incorrect grade of fuel
- Ignition timing incorrect
- Distributor faulty or worn
- Worn or maladjusted carburettor
- Excessive carbon build-up in engine

*Whistling or wheezing noises*

- Leaking vacuum hose
- Leaking carburettor or manifold gasket
- Blowing head gasket

*Tapping or rattling*

- Incorrect valve clearances
- Worn valve gear
- Worn timing chain or belt
- Broken piston ring (ticking noise)

*Knocking or thumping*

- Unintentional mechanical contact (eg fan blades)
- Worn drivebelt
- Peripheral component fault (generator, water pump etc)
- Worn big-end bearings (regular heavy knocking, perhaps less under load)
- Worn main bearings (rumbling and knocking, perhaps worsening under load)
- Piston slap (most noticeable when cold)

# Chapter 1 Engine

*For modifications, and information applicable to later models, see Supplement at end of manual*

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## Specifications

### General

Type .....	Transverse, four cylinder, in-line overhead camshaft
Designation .....	MA10
Bore .....	68.0 mm (2.68 in)
Stroke .....	68.0 mm (2.68 in)
Capacity .....	988 cc (60.29 cu in)
Compression ratio .....	9.5:1 (4-speed) or 10.3:1
Compression pressure (at 350 rev/min):	
Standard .....	192 lbf/in <sup>2</sup> (13.5 kgf/cm <sup>2</sup> )
Minimum .....	164 lbf/in <sup>2</sup> (11.5 kgf/cm <sup>2</sup> )
Maximum difference between cylinders .....	14 lbf/in <sup>2</sup> (1 kgf/cm <sup>2</sup> )
Firing order .....	1 - 3 - 4 - 2

### Cylinder block

Material .....	Aluminium alloy
Cylinder bore:	
Standard .....	68.00 to 68.03 mm (2.6772 to 2.6783 in)
Wear limit .....	0.1 mm (0.0039 in)
Maximum out-of-round .....	0.02 mm (0.0008 in)
Maximum taper .....	0.02 mm (0.0008 in)
Normal difference between bores .....	0.05 mm (0.002 in)
Maximum difference between bores .....	0.2 mm (0.0079 in)

### Crankshaft

Number of main bearings .....	5
Main journal diameter .....	44.95 to 44.97 mm (1.7697 to 1.7705 in)
Crankpin diameter .....	39.96 to 39.97 mm (1.5732 to 1.5736 in)
Maximum journal and crankpin out-of-round .....	Less than 0.01 mm (0.0004 in)
Endfloat (standard) .....	0.06 to 0.22 mm (0.0024 to 0.0087 in)
Endfloat (maximum) .....	0.5 mm (0.0197 in)
Main bearing running clearance:	
Standard .....	0.03 to 0.05 mm (0.0012 to 0.0020 in)
Maximum .....	0.075 mm (0.0030 in)
Connecting rod bearing clearance:	
Standard .....	0.02 to 0.06 mm (0.0008 to 0.0024 in)
Maximum .....	0.12 mm (0.0047 in)
Main bearing undersize .....	0.25 mm (0.0098 in)

### Flywheel run-out

0.15 mm (0.0059 in)

### Connecting rods

Big-end side play .....	0.10 to 0.37 mm (0.0039 to 0.0146 in)
Wear limit .....	0.5 mm (0.020 in)

### Gudgeon pin

Pin to piston clearance .....	0.008 to 0.012 mm (0.0003 to 0.0005 in)
Interference fit in small-end .....	0.017 to 0.038 mm (0.0007 to 0.0015 in)

**Pistons**

Piston skirt diameter (standard) .....	67.967 to 67.997 mm (2.6759 to 2.6770 in)
Oversize .....	0.5 mm (0.030 in)
Clearance in block .....	0.023 to 0.043 mm (0.0009 to 0.0017 in)

**Piston rings**

Type .....	Two compression, one oil control
Clearance in groove (standard):	
Top .....	0.04 to 0.08 mm (0.0016 to 0.0031 in)
2nd .....	0.03 to 0.06 mm (0.0012 to 0.0024 in)
Oil control .....	0.0 to 0.175 mm (0.0 to 0.0069 in)
Wear limit .....	0.2 mm (0.008 in)
Ring end gap:	
Top No 1 grade .....	0.21 to 0.30 mm (0.0083 to 0.0118 in)
Top No 2 and No 3 grade .....	0.18 to 0.30 mm (0.0071 to 0.0118 in)
2nd .....	0.15 to 0.39 mm (0.0059 to 0.0154 in)
Oil control .....	0.20 to 0.79 mm (0.0079 to 0.0311 in)

**Camshaft**

Outer diameter of journal .....	39.95 to 39.97 mm (1.5728 to 1.5736 in)
Camshaft bearing inner diameter .....	40.00 to 40.03 mm (1.5748 to 1.5760 in)
Journal-to-bearing clearance:	
Standard .....	0.03 to 0.07 mm (0.0012 to 0.0028 in)
Wear limit .....	0.15 mm (0.0059 in)
Endfloat .....	0.03 to 0.31 mm (0.0012 to 0.0122 in)

**Timing belt deflection (measured) midway on longest run**

2.0 mm (0.08 in) with applied force of 1.06 to 1.28 lbf (0.48 to 0.58 kgf)

**Cylinder head**

Material .....	Aluminium alloy
Surface out-of-true (limit) .....	0.1 mm (0.004 in)

**Valves**

Clearances (cold):	
Inlet .....	0.22 mm (0.009 in)
Exhaust .....	0.22 mm (0.009 in)
Clearances (hot):	
Inlet .....	0.25 mm (0.0098 in)
Exhaust .....	0.30 mm (0.0118 in)
Valve seat angle (inlet and exhaust) .....	45°15' to 45°45'
Valve spring free length .....	46.70 mm (1.8386 in)
Valve guides:	
Outer diameter .....	11.023 to 11.034 mm (0.4340 to 0.4344 in)
Inner diameter .....	7.005 to 7.020 mm (0.2758 to 0.2764 in)
Cylinder head valve guide hole diameter .....	10.960 to 10.978 mm (0.4315 to 0.4322 in)
Interference fit of valve guides .....	0.045 to 0.074 mm (0.0018 to 0.0029 in)
Stem to guide clearance:	
Inlet .....	0.015 to 0.045 mm (0.0006 to 0.0018 in)
Exhaust .....	0.045 to 0.075 mm (0.0018 to 0.0030 in)

**Lubrication**

Oil pressure at 1200 rev/min .....	28 lbf/in <sup>2</sup> (2.0 kgf/cm <sup>2</sup> )
Oil pressure at 2000 rev/min .....	43 lbf/in <sup>2</sup> (3.0 kgf/cm <sup>2</sup> )
Oil pump:	
Rotor tip clearance .....	0.2 mm (0.008 in)
Outer rotor to body clearance .....	0.2 mm (0.008 in)
Rotor endfloat .....	0.2 mm (0.008 in)
Engine oil capacity (including filter) .....	2.7 litre (4.75 pt)
Oil type/specification .....	Multigrade engine oil, viscosity range SAE 10W/30 to 15W/50, to API SE or SF (Duckhams QXR, Hypergrade, or 10W/40 Motor Oil)

**Torque wrench settings**

	lbf ft	kgf m
Alternator bracket bolt .....	6.7 to 8.7	0.93 to 1.2
Alternator adjuster link bolt .....	6.7 to 8.7	0.93 to 1.2
Alternator to bracket .....	16 to 22	2.2 to 3.0
Clutch cover fixing bolt .....	12 to 15	1.6 to 2.1
Engine mounting to cylinder head .....	29 to 36	4.0 to 5.0
Engine mounting to cylinder block .....	29 to 36	4.0 to 5.0
Fuel pump mounting nuts .....	6.5 to 8.7	0.9 to 1.2
Inlet and exhaust manifold nuts .....	12 to 15	1.6 to 2.1
Oil pump idler gear bolts .....	12 to 15	1.6 to 2.1
Oil pump securing bolt .....	13 to 16	1.8 to 2.2
Power-steering pump bracket .....	12 to 15	1.6 to 2.1

**Torque wrench settings**

	lbf ft	kgf m
Power steering pump mounting bolt .....	23 to 31	3.2 to 4.3
Spark plugs .....	18 to 22	2.5 to 3.0
Water pump bolts .....	2.9 to 3.6	0.4 to 0.5
Air conditioner compressor bracket .....	22 to 30	3.1 to 4.1
Crankshaft pulley nut .....	61 to 69	8.5 to 9.5
Thermostat housing bolts .....	2.9 to 3.6	0.4 to 0.5
Oil pressure switch .....	9 to 12.7	1.25 to 1.75
Camshaft pulley bolt .....	6.5 to 8.7	0.9 to 1.2
Connecting rod nut .....	22 to 25	3.0 to 3.5
Cylinder head bolts:		
1st stage .....	25 to 29	3.5 to 4.0
2nd stage .....	43 to 47	6.0 to 6.5
Flywheel bolts .....	43 to 51	6.0 to 7.0
Driveplate bolts .....	51 to 58	7.0 to 8.0
Main bearing cap bolts .....	34 to 38	4.7 to 5.3
Oil sump bolts .....	2.9 to 3.6	0.4 to 0.5
Oil sump drain plug .....	26 to 35	3.6 to 4.8
Oil strainer bolts .....	4.3 to 5.8	0.6 to 0.8
Rocker shaft bolts .....	13 to 15	1.8 to 2.1
Tensioner lock nut .....	11 to 12	1.5 to 1.7
Rocker cover nut .....	2.2 to 3.6	0.3 to 0.5
Rocker arm locknut .....	8 to 11	1.1 to 1.5

**1 General description**

The new MA10 engine, designed specifically for the Micra is a lightweight, compact, all alloy engine. It is conventional, being of four-cylinder, in-line overhead cam design.

The cylinder head has a crossflow design, with hemispherical combustion chambers, the valves being driven from the camshaft, which in turn is driven by toothed belt from the crankshaft.

The crankshaft is supported in five main bearings mounted within a one-piece bearing cap. Main bearings and big-end bearings are of the white metal lined shell type, and are readily renewed, but the gudgeon pins require specialist equipment for removal and refitting. The camshaft runs in bearings machined directly into the cylinder head.

**2 Routine maintenance**

- 1 At weekly intervals, check the engine oil level. Do this by withdrawing the dipstick, wiping it clean, reinserting it and withdrawing it for the second time.
- 2 The oil level should be between the L and H marks. Top up if necessary.
- 3 Change the engine oil and oil filter every 6000 miles (10 000 km) or 6 months, whichever comes the sooner.
- 4 The oil should be drained when hot by removing the oil filler cap and the sump drain plug (photo). Use a large bowl to catch the oil.



2.4 Oil sump drain plug

- 5 Using a suitable filter removal tool, unscrew the cartridge type oil filter which is located on the cylinder block just to the rear of the alternator (photo). Be prepared for some spillage of oil.

- 6 Wipe the filter mating face on the cylinder block clean and smear the rubber sealing ring of the new filter with a little oil. Screw on the filter hand-tight only.

- 7 Refit the sump drain plug.

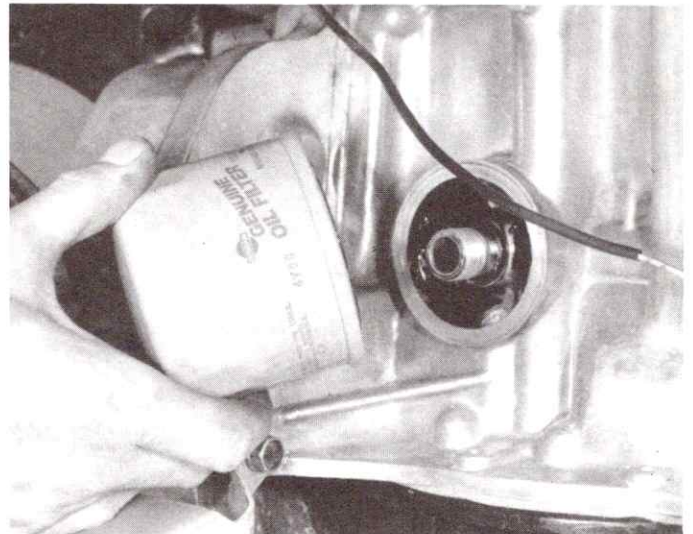
- 8 Refill with the correct quantity and type of engine oil. Refit the oil filler cap.

- 9 Every 12 000 miles (20 000 km) or 12 months whichever comes first, check the crankcase ventilation system hoses for condition and security.

**3 Major operations possible without removing the engine**

The following operations may be carried out with the engine in position in the vehicle.

- Removal and refitting of the cylinder head*
- Adjustment of the valve clearances*
- Removal and refitting of the timing belt*
- Removal and refitting of the oil pump*
- Removal and refitting of the sump*
- Removal of piston rings and big-end bearings*

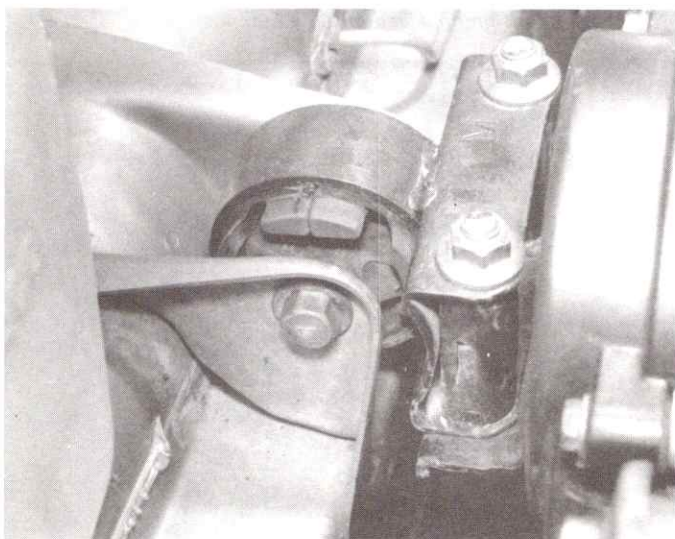


2.5 Removing the oil filter cartridge

#### 4 Cylinder head – removal and refitting

**Note:** the procedure given here describes the removal operation with the engine in situ. Later texts describe the overhaul procedure with the engine removed from the vehicle.

- 1 Disconnect the battery.
- 2 Disconnect the HT and LT leads to the distributor and remove it and the spark plugs (Chapter 4).
- 3 Remove the air cleaner, then disconnect all fuel lines, control cables, hoses and electrical leads to the carburettor (Chapter 3).
- 4 Drain the cooling system and remove the radiator (Chapter 2).
- 5 Remove the collector plate from around the exhaust manifold, and disconnect the exhaust downpipe (Chapter 3).
- 6 Remove the exhaust manifold and inlet manifold, complete with carburettor.
- 7 Raise the car and support the front end of the vehicle on axle stands.
- 8 Remove the right-hand engine shield.
- 9 Remove the right-hand road wheel.
- 10 Support the engine under the oil sump and remove the right-hand engine mounting (photo). (This gives access to the timing belt covers).
- 11 Remove the alternator drivebelt, and if fitted the power and air conditioner pump drivebelts (Chapter 2).
- 12 By means of a socket on the crankshaft pulley nut, set the engine timing marks to TDC on the compression stroke (photo).
- 13 Remove the crankshaft pulley.
- 14 Remove the timing cover (photo). Note the earth lead attached to the cover securing bolt (photo).
- 15 Release the timing belt tensioner (photo) and return spring and remove the timing belt. Do not rotate either the camshaft or crankshaft once the timing belt has been removed as damage may result from a valve hitting a piston.
- 16 Remove the rocker cover (photo).
- 17 Undo and remove the two bolts retaining the oil pump idler gear and remove the idler gear and driveshaft (photo).
- 18 Loosen the cylinder head bolts progressively in the reverse order to the tightening sequence (photo). Remove the bolts.
- 19 Remove the cylinder head carefully. If further dismantling is to be carried out, refer to the relevant Sections of this Chapter. If difficulty is experienced removing the head, tap it gently around the sides using a soft-faced mallet.
- 20 Before refitting the cylinder head, make sure all traces of old gasket are removed from the mating surfaces of the cylinder head and block. **(Note: the alloy used in the construction of the engine is easily damaged by scrapers and screwdrivers so be careful when cleaning off old gasket. Paint stripper will help to remove stubborn pieces of gasket and carbon.)**



4.10 Right-hand engine mounting

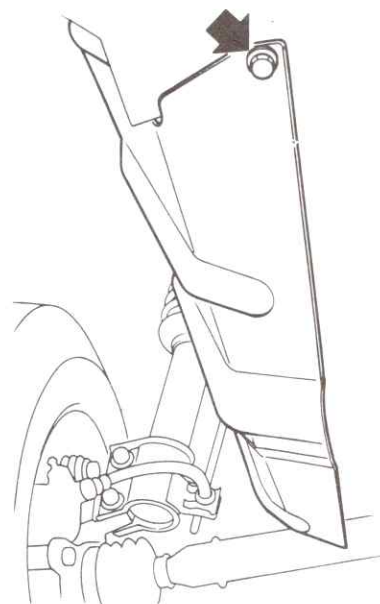
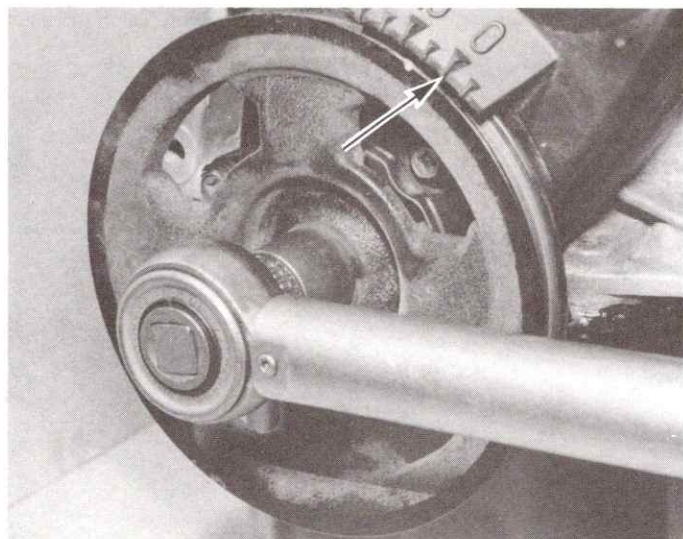
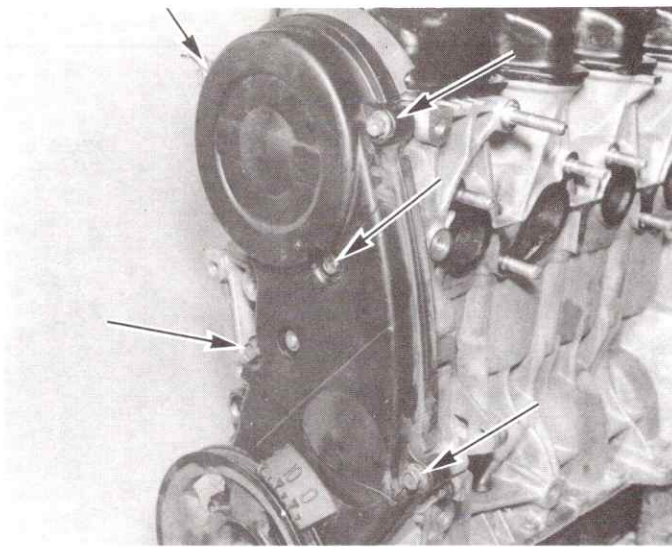


Fig. 1.1 Right-hand engine shield (Sec 4)

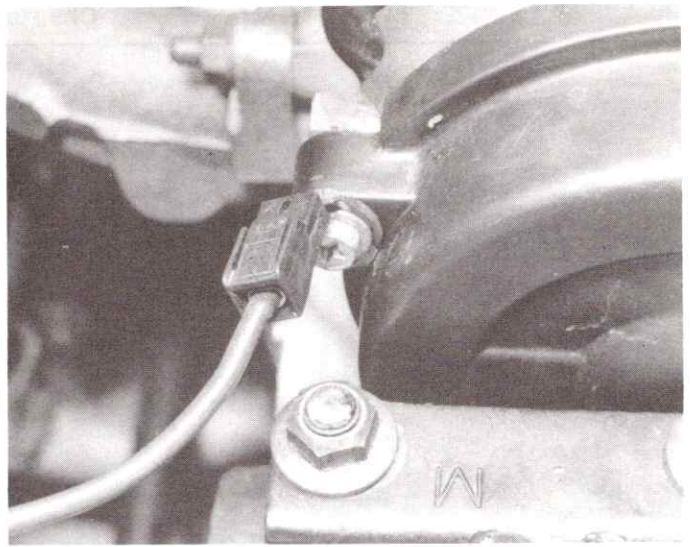
- 21 Clean out oil from the cylinder block bolt holes, clean the cylinder head bolts and oil them lightly with clean engine oil.
  - 22 Fit a new cylinder gasket to the cylinder block (photo).
  - 23 Before lowering the cylinder head into position turn the camshaft by means of the drive sprocket to line up the zero mark with the notch on the cylinder head. This will prevent damage to the pistons and valves by ensuring their correct relative position.
  - 24 Lower the cylinder head carefully onto the block (photo) and ensure it seats correctly.
  - 25 Fit the cylinder head bolts, with their washers. Tighten the bolts progressively in the correct sequence (Fig. 1.2) to the 1st stage torque figures given in the Specification, then loosen each bolt, again in reverse sequence, and finally re-torque to the 2nd stage specified setting, again on the sequence shown in Fig. 1.2.
- Note:** Do not rotate the crankshaft or camshaft without the drivebelt being fitted or the valves will hit the pistons.



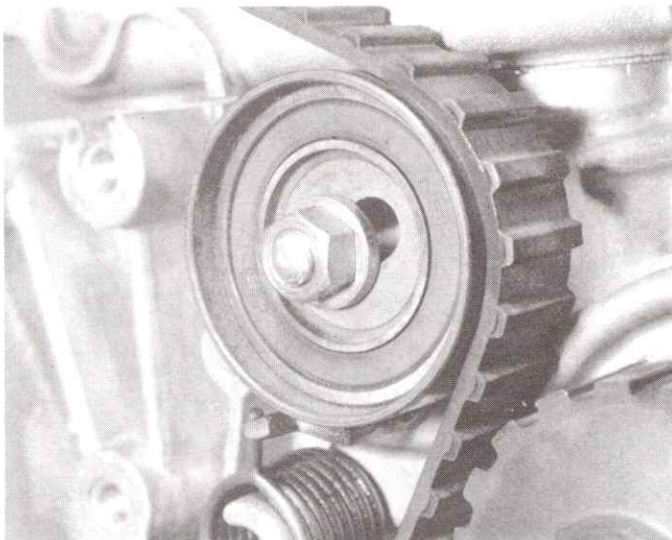
4.12 Aligning the crankshaft pulley mark with the 0° (TDC) mark



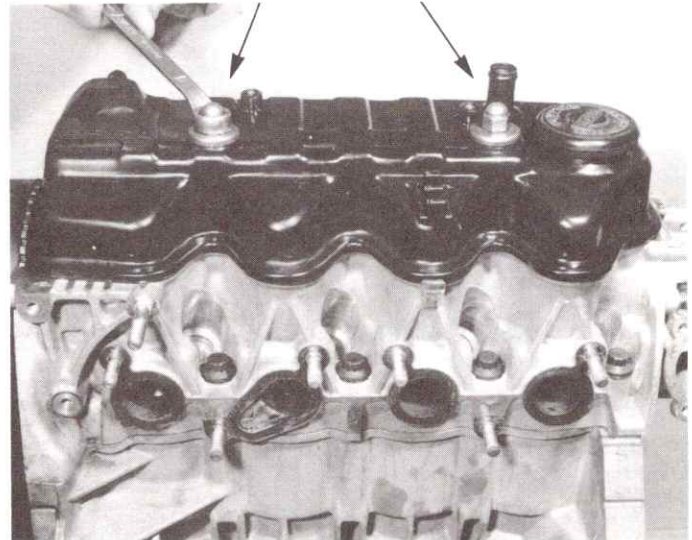
4.14A Upper timing belt cover retaining bolts



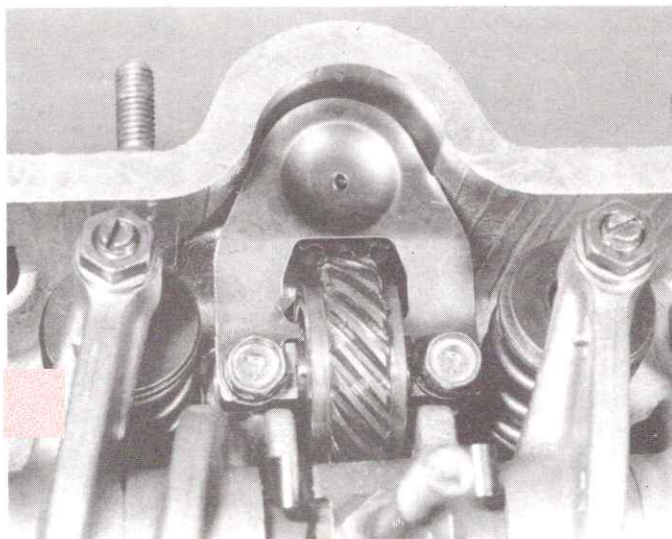
4.14B Remember the earth lead when refitting



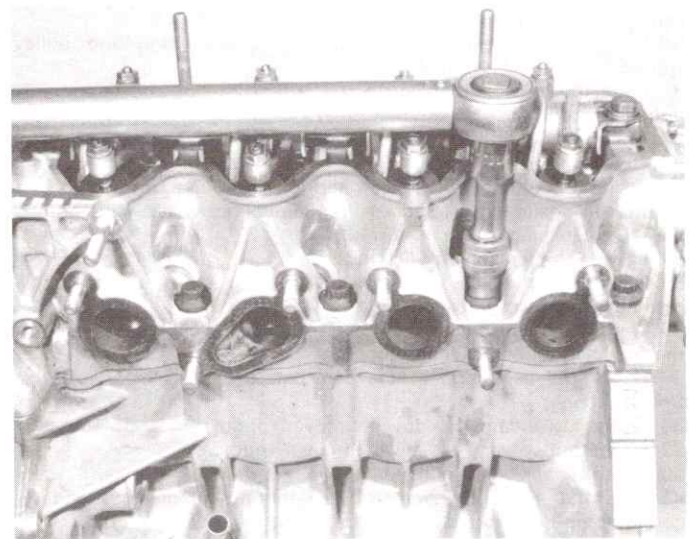
4.15 Timing belt tensioner pulley



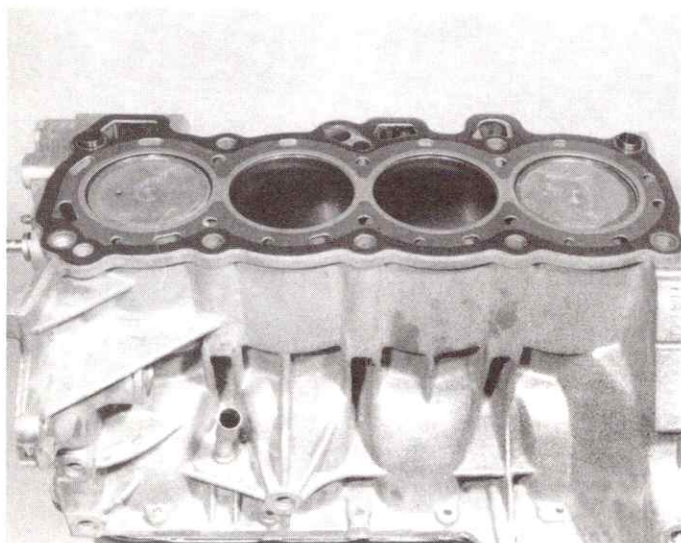
4.16 Remove the rocker cover (retaining nuts arrowed)



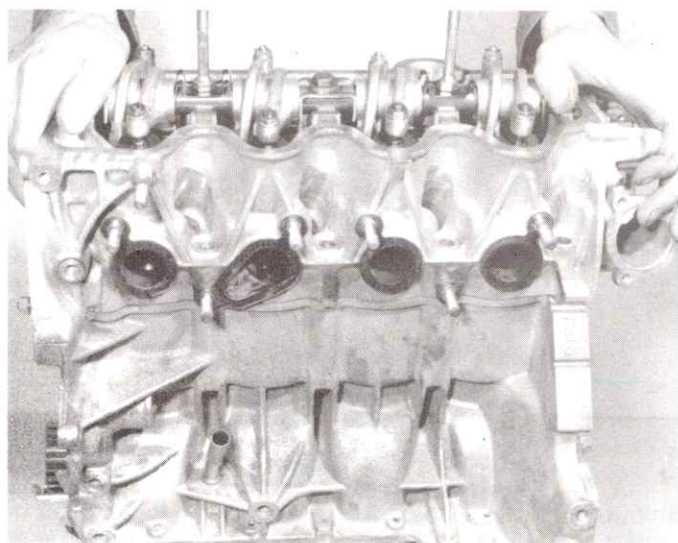
4.17 Oil pump idler gear. The central dish faces downwards



4.18 Loosening the cylinder head bolts



4.22 Cylinder head gasket in position



4.24 Placing the cylinder head on the cylinder block

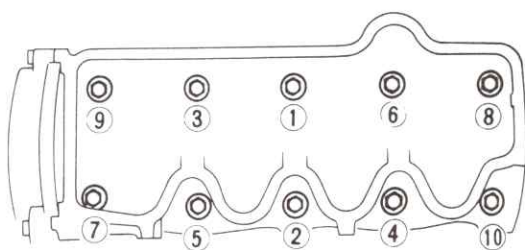
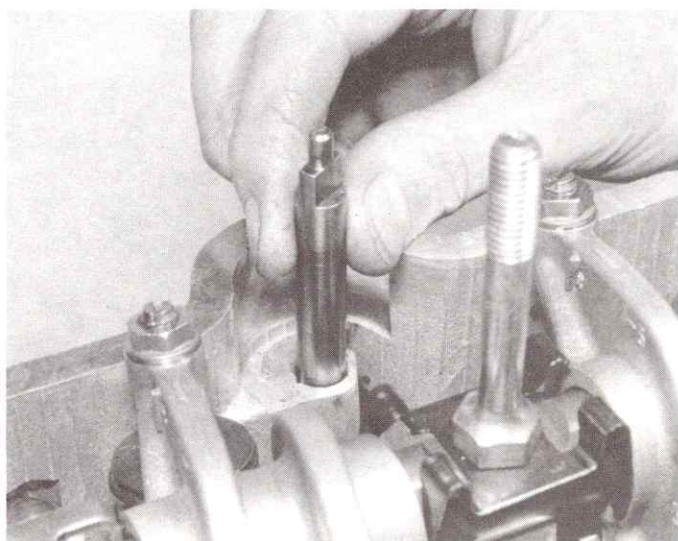
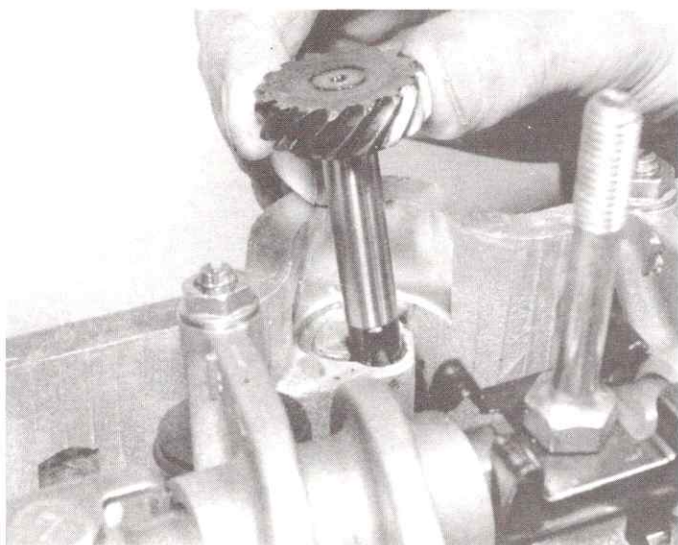


Fig. 1.2 Cylinder head bolt tightening sequence (Sec 4)

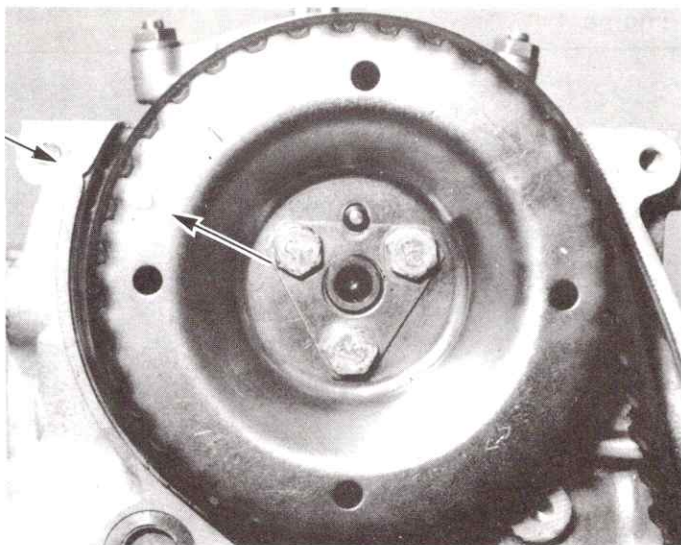
- 26 Refit the oil pump driveshaft (photo).
- 27 Refit the oil pump idler gear (photo).
- 28 Bolt on the oil pump retainer plate, ensuring the dish faces downwards.
- 29 Check the alignment marks on the crankshaft sprocket and camshaft sprocket are lined up (photos).
- 30 If they were removed, refit the tensioner spring and pulley (photos).
- 31 Slide the tensioner pulley to the left in its slot and temporarily tighten the bolt.
- 32 Check that both the tensioner pulley and coolant pump sprocket turn freely.
- 33 Ensure the timing belt is clean and free from oil and water, before fitting it in position, make sure its directional arrow faces the correct way (it rotates clockwise as you look at it).
- 34 Loosen the tensioner pulley locknut.
- 35 Using a peg spanner on the camshaft sprocket, rotate the whole assembly two turns anti-clockwise.
- 36 Tighten the tensioner locknut and re-check the alignment marks on the camshaft and crankshaft sprockets.
- 37 Check the deflection at the camshaft belt (see Fig. 1.3) (see Specifications).
- 38 Fit the lower camshaft drivebelt cover (photo).
- 39 Fit the upper camshaft drivebelt cover (photo).
- 40 Refit the crankshaft pulley.
- 41 Refit the alternator drivebelt and the power steering and air conditioning pump bolts if these are fitted.
- 42 Refit the right-hand engine mounting, remove the support from under the oil sump, refit the roadwheel and lower the vehicle to the ground.



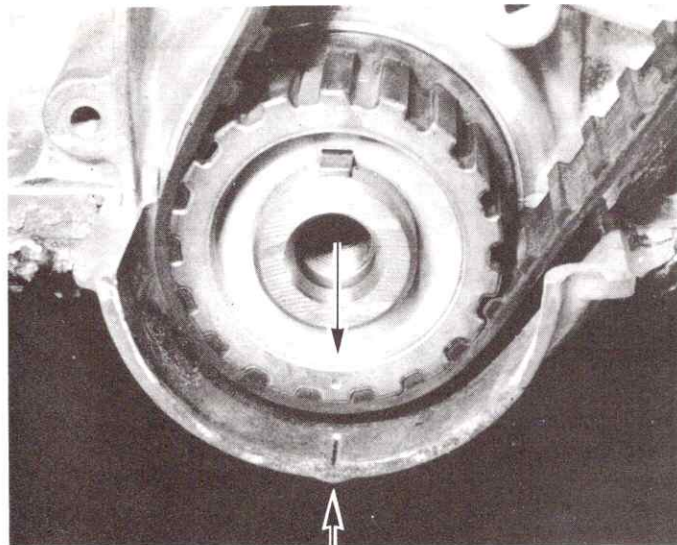
4.26 Fitting the oil pump driveshaft ...



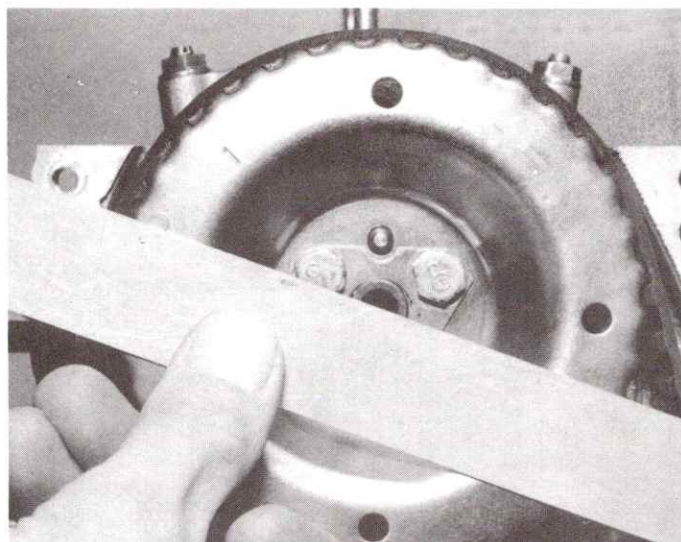
4.27 ... and the idler gear



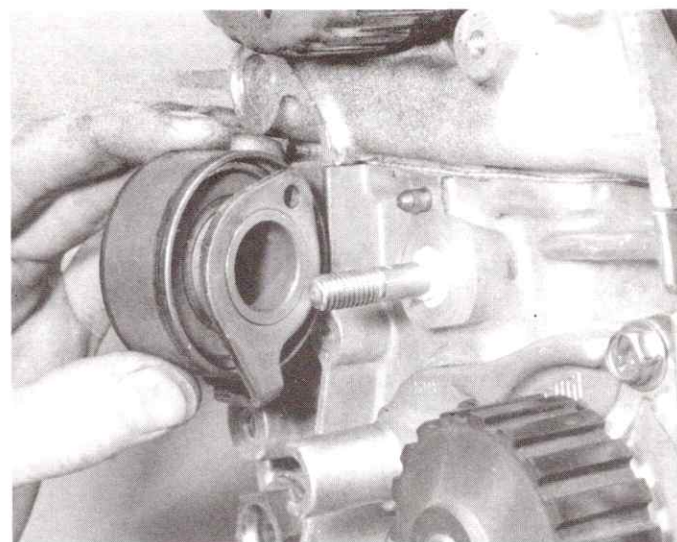
4.29A Camshaft sprocket alignment marks



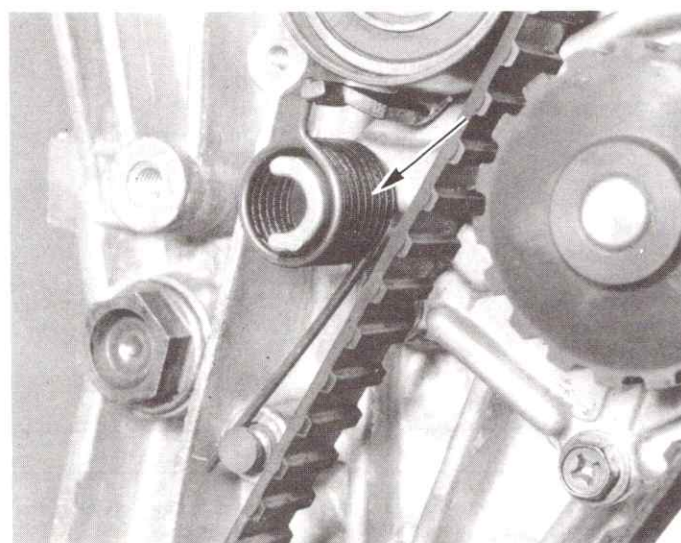
4.29B Crankshaft sprocket alignment marks



4.29C Checking alignment



4.30A Refitting the tensioner pulley ...



4.30B ... and spring

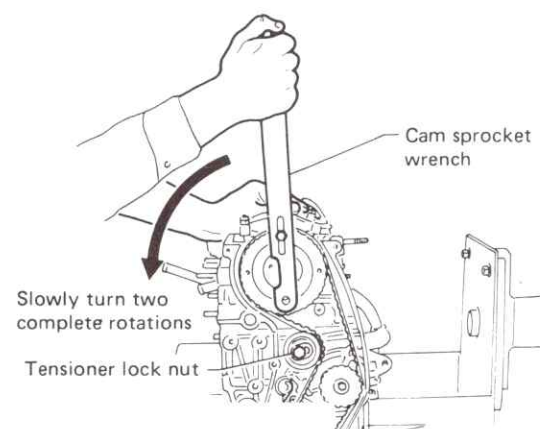
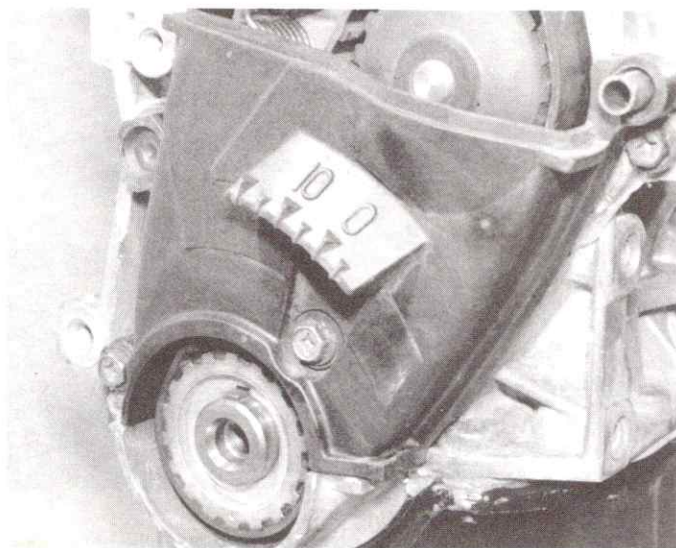
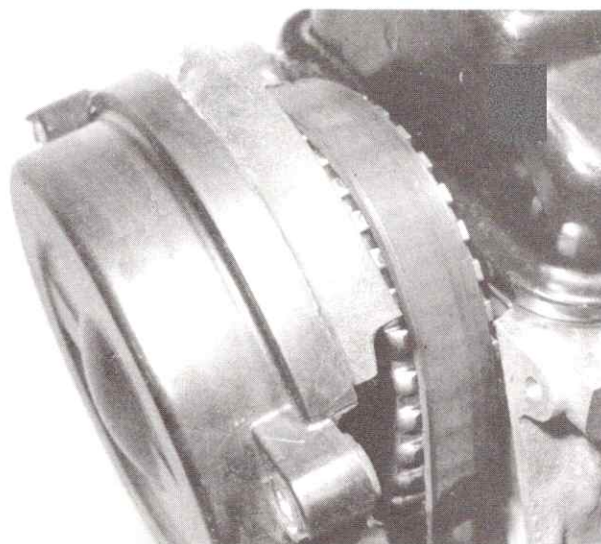


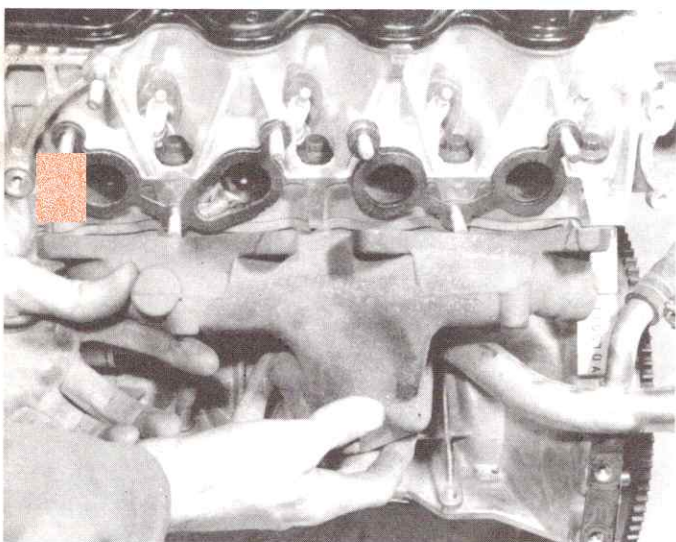
Fig. 1.3 Check belt deflection after tightening the locknut (Sec 4)



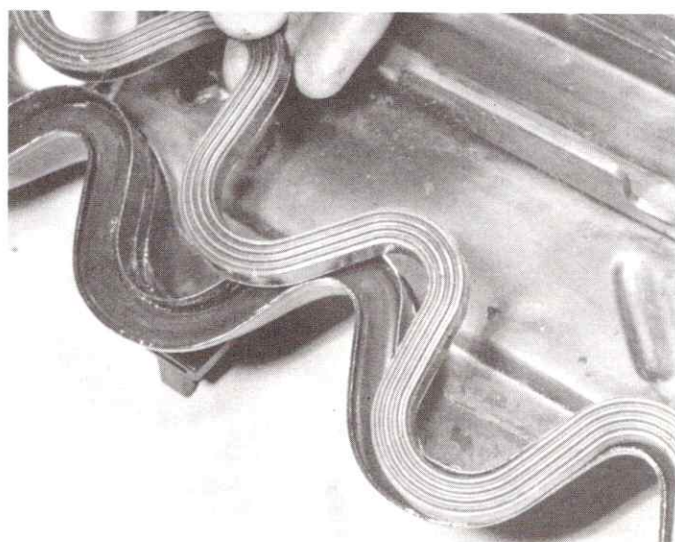
4.38 Lower timing belt cover



4.39 Fitting the upper timing belt cover



4.44 Fitting the exhaust manifold



4.49A Use a new seal ...



4.49B ... when fitting the rocker cover

- 43 Refit the right-hand engine shield.
- 44 Refit the exhaust manifold (photo) and connect up the downpipe. Fit the collector plate.
- 45 Refit the inlet manifold, and reconnect the carburettor fuel lines, electrical leads, control cables and hoses (refer to Chapter 3).
- 46 Refit the distributor HT and LT leads and spark plugs (Chapter 4).
- 47 Refill the cooling system (Chapter 2).
- 48 Adjust valve clearances (see Section 5).
- 49 Fit a new gasket to the rocker cover before bolting it in position (photos).
- 50 Check engine oil level.
- 51 Reconnect the battery.

## 5 Valve clearances – adjustment

- 1 When this adjustment is being carried out at a routine servicing, the engine should be at normal operating temperature.
- 2 Remove the air cleaner and the rocker cover, also the spark plugs.
- 3 Using a socket wrench on the crankshaft pulley bolt, turn the crankshaft until No 1 piston (at timing belt end of the engine) is at

TDC. This can be ascertained if a finger is placed over No 1 cylinder spark plug hole and the compression felt as it is being generated as the piston rises. The notch on the crankshaft pulley should be opposite the 0 mark on the timing scale.

4 Using a feeler blade of specified thickness check that it is a stiff sliding fit between the end of the valve stem and the ball end of the rocker arm adjuster screw on valves 1, 2, 3 and 6 (Fig. 1.4).

5 Where the clearance is not as specified, release the rocker arm adjuster screw locknut and turn the screw. Once the correct clearance is established, tighten the locknut without allowing the adjuster screw to turn (photo).

6 Now set No 4 piston at TDC on its compression stroke and repeat the operations on valves 4, 5, 7 and 8.

7 Check that the rocker cover gasket is in good order, refit the rocker cover, air cleaner and spark plugs.

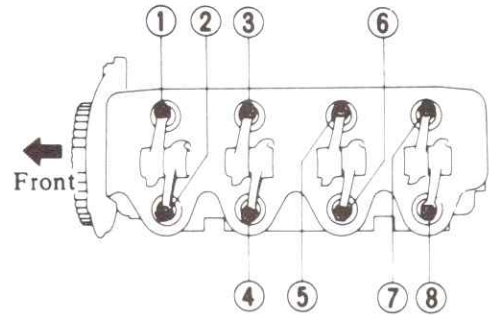


Fig. 1.4 Valve adjusting sequence (Sec 5)

## 6 Timing belt – removal and refitting

1 It is recommended that the timing belt is renewed after 60 000 miles (100 000 km) have been covered.

2 Removal, refitting and tensioning operations are as described in Section 4.

## 7 Sump pan – removal and refitting

1 Drain the engine oil.

2 Unbolt the reinforcement struts from the rear corner of the sump and transmission.

3 Disconnect the exhaust downpipe from the manifold and release the exhaust pipe front mounting.

4 Unscrew and remove the sump pan bolts and nuts. The nut nearest the transmission is very inaccessible and will require the use of a universally-jointed drive extension and socket to remove it.

5 Remove the sump pan by pulling the exhaust pipe downwards.

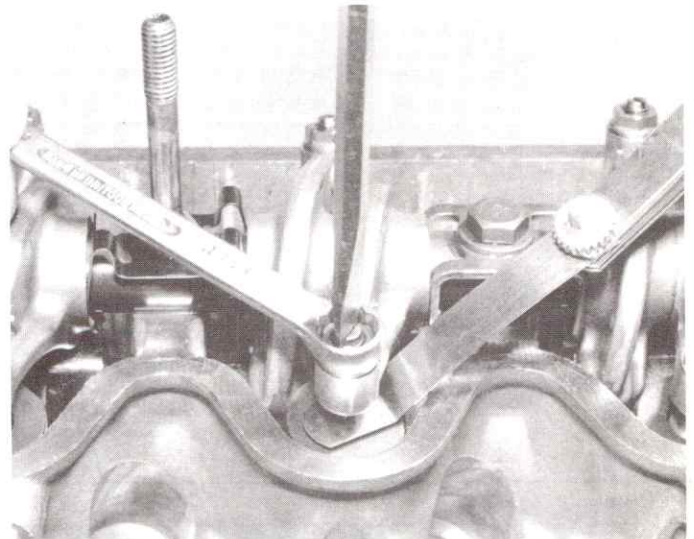
6 Remove and discard the old gaskets.

7 Before fitting the sump pan, stick new side gaskets and end sealing strips in position with gasket cement. Make sure that the ends of the sealing strips overlap the side gaskets. Cover the seam with a generous blob of cement (photo).

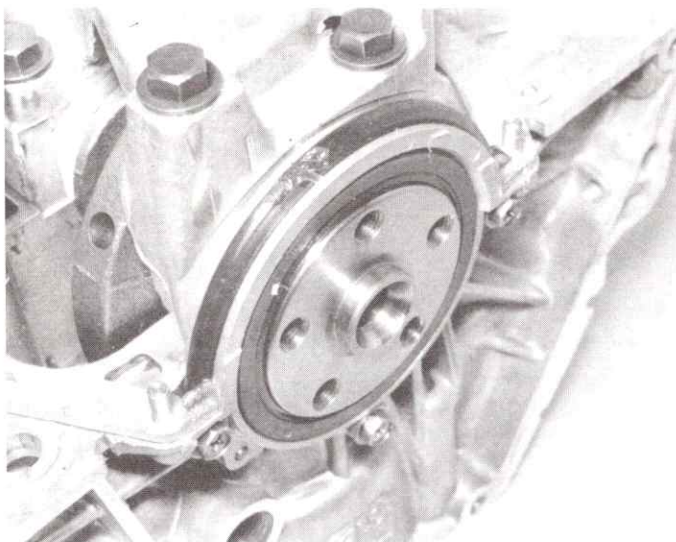
8 Screw in the sump bolts and fit the nuts, tightening them evenly (photo).

9 Reconnect the exhaust pipe.

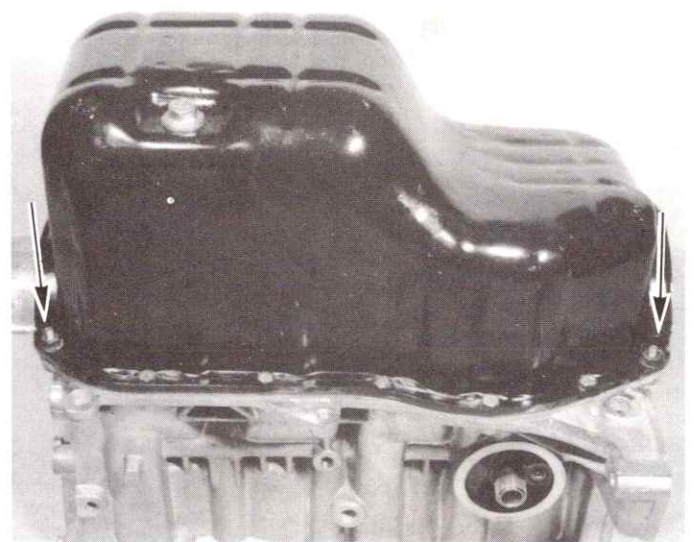
10 Fill the engine with oil.



5.5 Adjusting the valve clearances



7.7 Fitting new gaskets, using sealing compound



7.8 Sump pan bolts – note the four nuts are at each corner

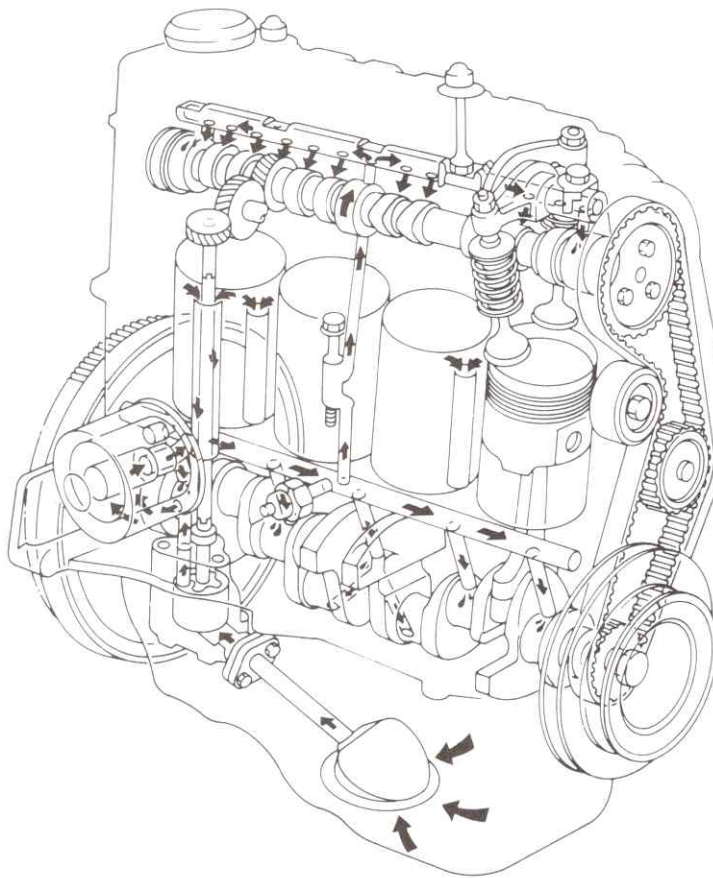


Fig. 1.5 Oil system flow diagram (Sec 8)

## 8 Oil pump – general

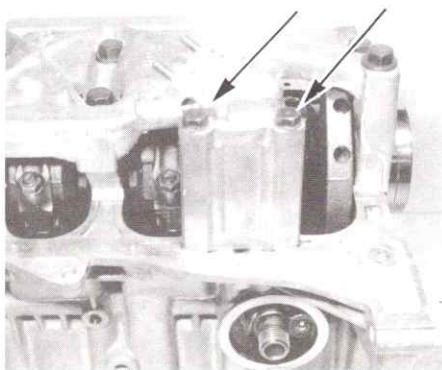
- 1 The oil pump, which is trochoidal, is bolted to the cylinder block within the sump.
- 2 It is driven by skew gear and shafts from the camshaft.
- 3 A spring plate, which is held in place by the bolts which retain the idler gear, keeps the vertical shaft in position.
- 4 The oil pump may be removed with the engine in situ, but note that our photographs in the following text were taken with the engine removed for clarity.

## 9 Oil pump – removal, inspection and refitting

- 1 Remove the sump pan as described in Section 7.
- 2 Undo the two retaining nuts and remove the oil pick up arm and strainer (photo).
- 3 Remove the bolts holding the pump to the cylinder block (photo) and remove the pump. (Be ready to catch the vertical driveshaft if this is being done in situ.)
- 4 Remove the remaining bolt and take off the end cap (photo).



9.2 Removing the oil strainer



9.3 Pump retaining bolts



9.4 Remove the remaining bolt and remove end cap

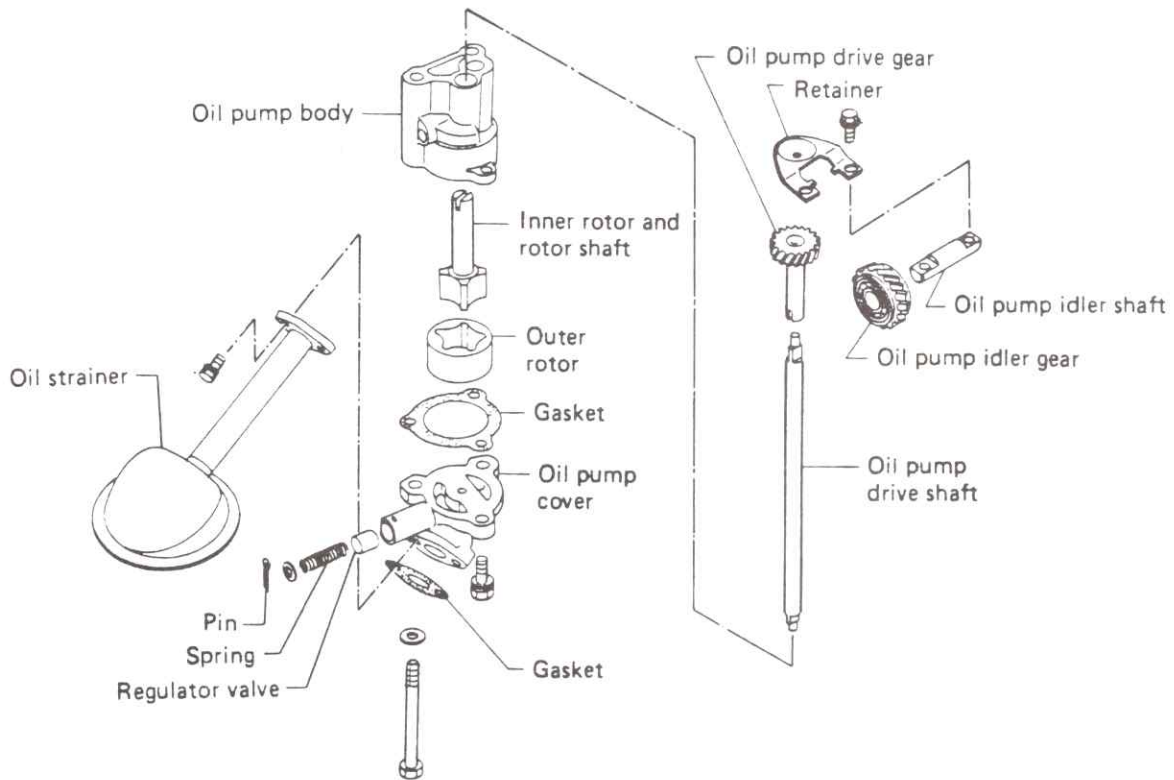


Fig. 1.6 Exploded view of oil pump (early models) (Sec 9)

5 Extract the split pin from the relief valve housing and remove the spring and plunger (photos).

6 The inner rotor and shaft and outer rotor may now be removed (photo).

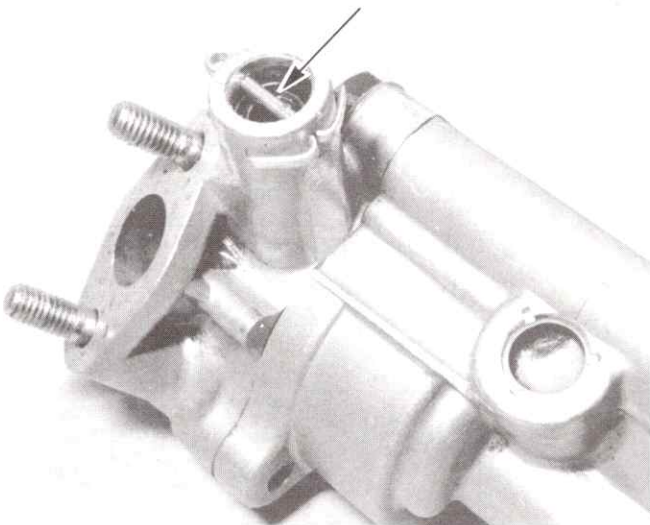
7 Measure the rotor tip clearance, outer rotor clearance and endfloat (photos) and compare them with the tolerances in the Specifications. If any parts are worn beyond the specified limits renew the whole assembly.

8 Refitting is a reversal of removal, but use new gaskets. If the job is being done in situ then remove the rocker cover and the oil pump idler gear as described in Section 4 and refit the driveshaft and idler gear

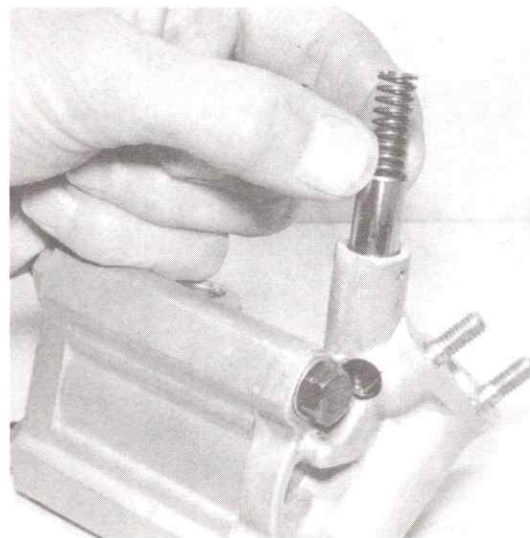
after the pump is bolted in place (photo). This will ensure the driveshaft slots and tongues are meshed correctly. Wash the oil strainer in petrol and dry it before refitting. Oil all parts liberally during reassembly.

9 On later models a spring stopper has been added to the idler gear assembly and to improve performance, the direction of the oil pump drivegear teeth has been changed. This changes the rotational direction of the pump from clockwise to anti-clockwise.

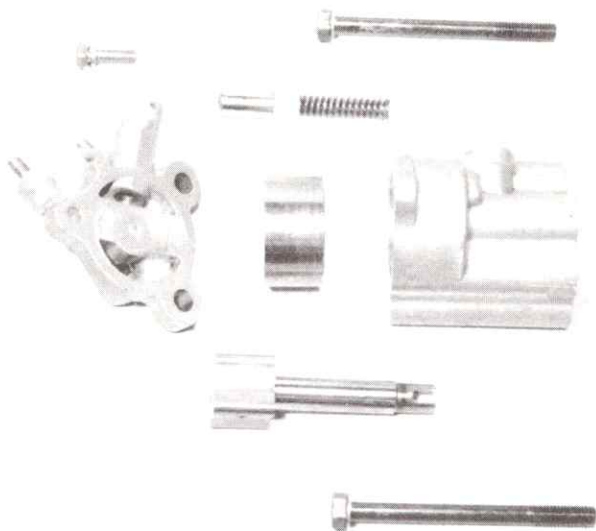
10 This means that the new pumps can only be fitted with the new camshaft. Ensure all new parts are compatible.



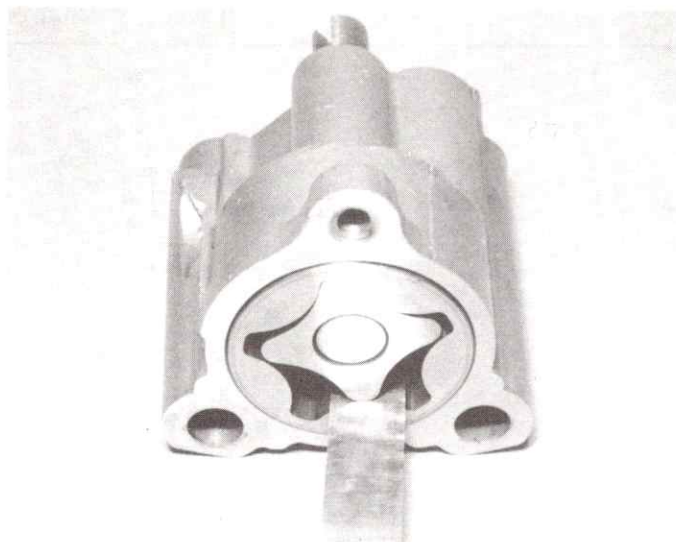
9.5A Split pin retaining the relief valve plunger



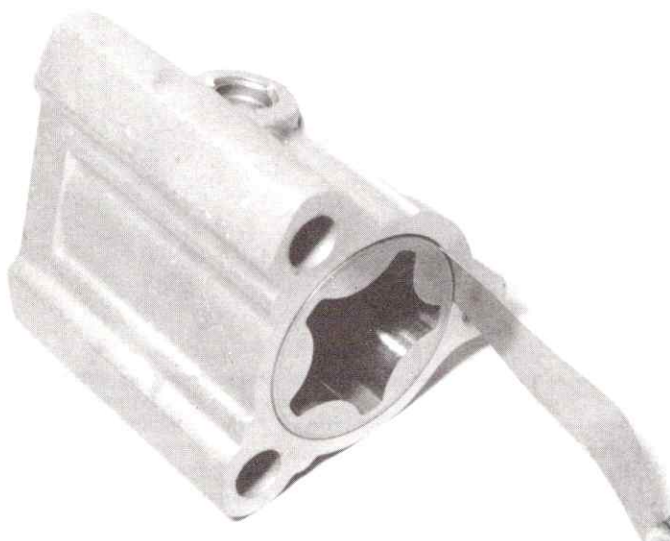
9.5B Removing the relief valve



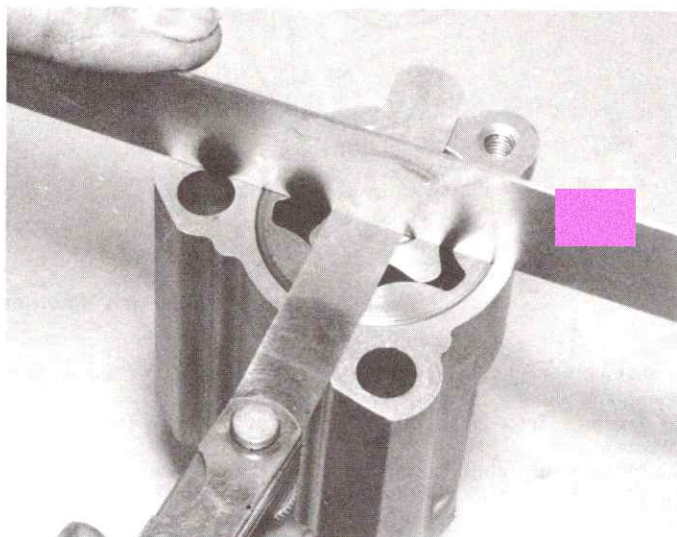
9.6 Component parts of the oil pump



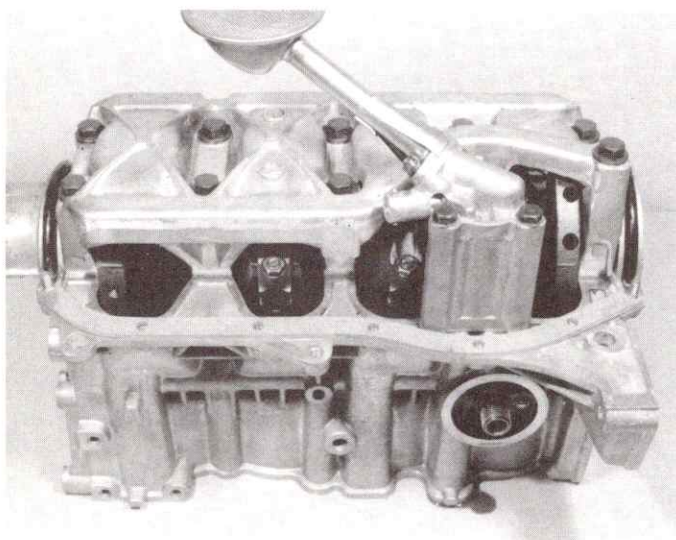
9.7A Measuring rotor tip clearance ...



9.7B ... outer rotor clearance ...



9.7C .. and endfloat



9.8 Strainer bolted in position

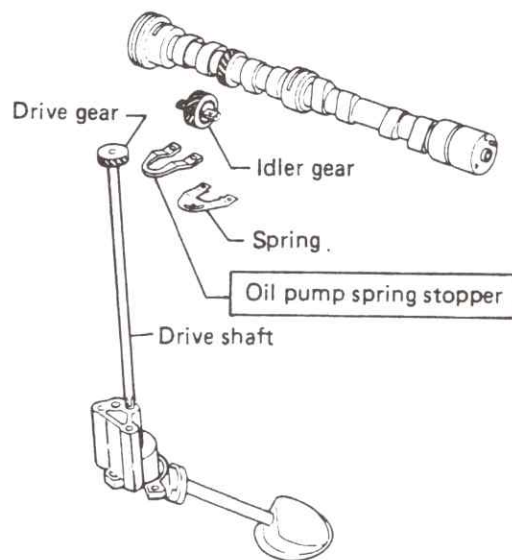


Fig. 1.7 Later models have a sprung stopper (Sec 9)

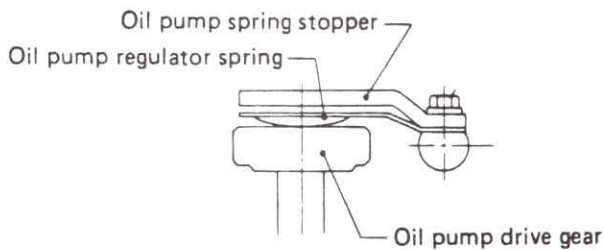
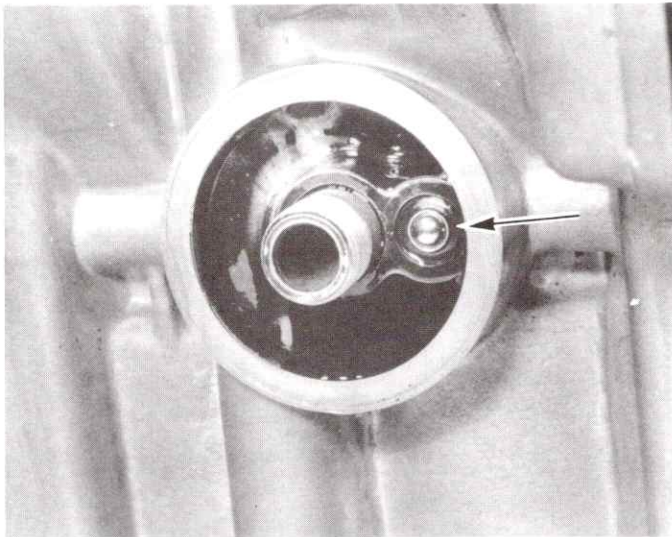


Fig. 1.8 Correct assembly of regulator spring (Sec 9)

### 10 Oil filter – removal and refitting

- 1 The oil filter screws into its housing on the rear face of the engine block, below the inlet manifold.
- 2 If an old filter is difficult to remove, use a strap wrench, or alternatively, drive a screwdriver right through the body of the filter and use it to unscrew the filter. Be prepared for some oil spillage during removal.
- 3 The oil filter housing incorporates a bypass valve, which is a spring loaded ball bearing. This will open to allow oil passage should the filter become blocked during service (photo).
- 4 When fitting a new filter, oil the seal lightly to prevent sticking, and only do the filter canister up hand tight.
- 5 Fill the engine with oil, then run the engine and check for leaks. It is usual for the oil pressure warning light to remain on for a few seconds whilst the new filter is filling with oil.



10.3 Oil filter housing (bypass valve arrowed)

### 11 Piston rings and big-end bearing shells – renewal

- 1 The choice of renewal of piston rings or substitution with special proprietary rings may be made as a means of reducing heavy oil consumption. The opportunity should also be taken to examine and renew if necessary the big-end bearings.

- 2 Remove the cylinder head and sump, as described in earlier Sections.
- 3 Note that the connecting rod big-end caps are numbered with matching numbers on adjacent machined surfaces on the connecting rod (photo). Note to which side of the crankcase the numbers face.
- 4 Undo the big-end cap bolts and remove the caps (photo).
- 5 If the bearing shells are to be used again, keep them in their correct order with the connecting rods. Do not mix them.
- 6 Push the pistons and connecting rods up and out of the cylinder bores. If the cylinder bores are severely worn and a ridge can be felt around the top of the bores, this may have to be reduced by careful reaming before the pistons will pass through.
- 7 Remove the piston rings by sliding pieces of old feeler gauge blades under them at three equidistant places and then sliding the rings off the piston.
- 8 Clean the piston ring grooves, removing all traces of gum and carbon. (A piece of old piston ring is ideal for this purpose.)
- 9 Check that the new rings have the correct groove clearance (photo) and end gap (photo).
- 10 Fit the rings to the pistons by reversing the removal operation.
- 11 The rings are marked on their upper surfaces.
- 12 If using new rings then the bores should be honed to remove the hard glaze. Use a rotary abrasive flap wheel.
- 13 The piston ring gaps should be staggered at equidistant points around the piston circumference, oil the rings and pistons liberally and use a ring compressor when fitting the pistons to bores.
- 14 Oil the cylinder bores and insert the first piston/con rod assembly, con rod first, into No 1 cylinder. Push it in until the piston ring compressor rests on the block (photo).
- 15 Now push the piston into the bore, which will release the ring compressor. Repeat on the remaining pistons.

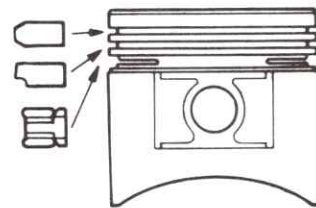
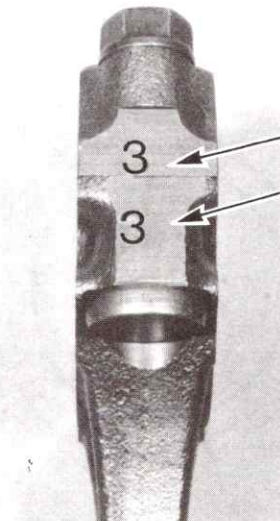


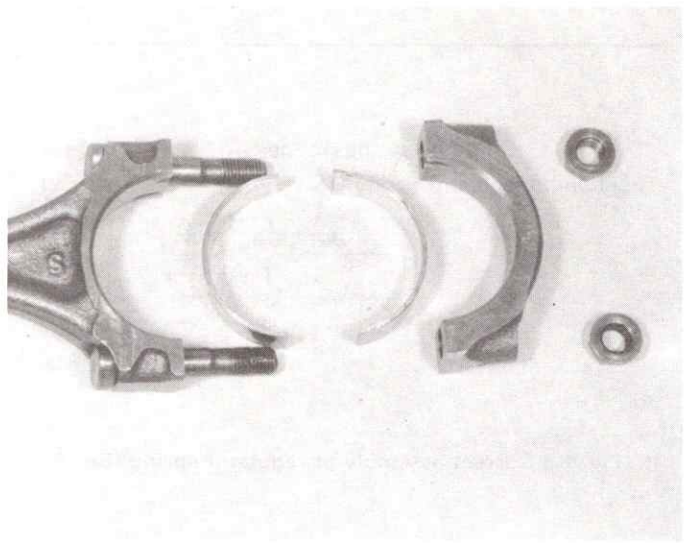
Fig. 1.9 Piston ring arrangement (Sec 11)



11.3 Matching numbers are stamped on the faces



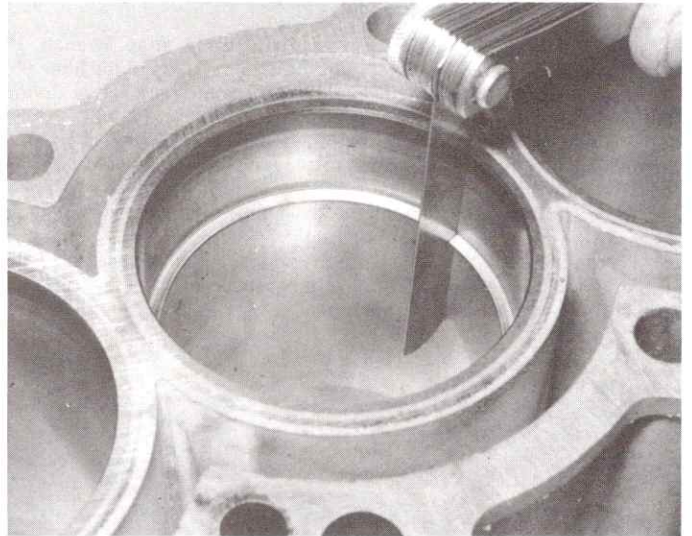
11.4A Big-end cap bolts



11.4B Big-end caps, shells and bolts



11.9A Measuring piston ring groove clearance ...



11.9B ... and end gap

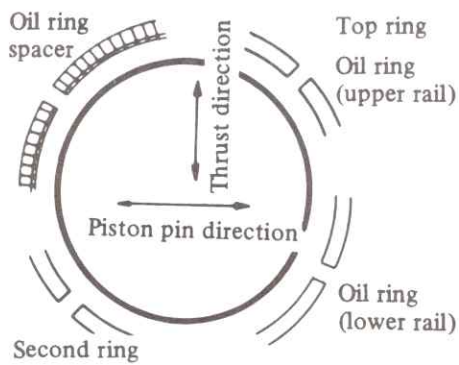
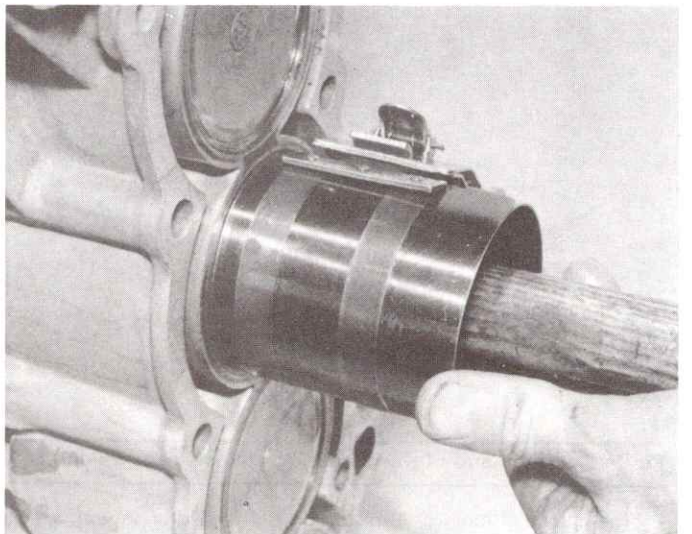
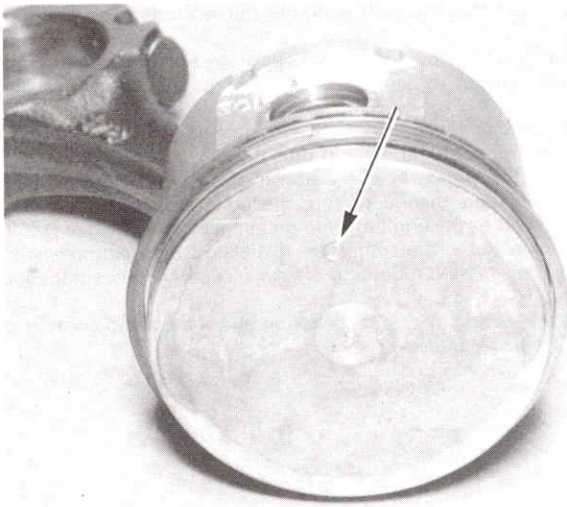


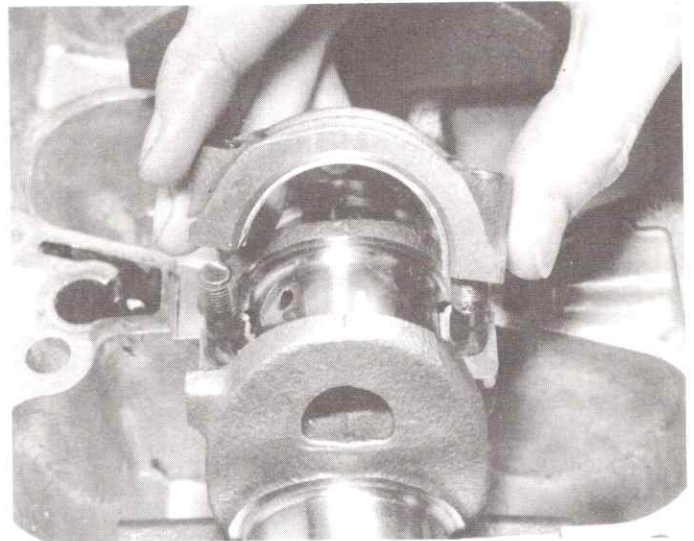
Fig. 1.10 Piston ring end gap orientation (Sec 11)



11.14 Using a ring compressor on the piston



11.16 Piston alignment mark should face the timing belt end when inserting the piston



11.19 Fitting a big-end bearing cap

16 Make sure the mark on the piston faces the timing belt end of the block (photo).

17 Draw each con rod/piston assembly down to the crankshaft. Oil each crankpin liberally and check that the big-end bearing shells are returned to their original positions.

18 Unless the shells are in excellent condition, with no signs of the copper underlay showing through, they should be renewed. The size is stamped on the back of the shell. Standard shells are unmarked or stamped 0-00.

19 Fit the big-end bearing caps with their shells, ensuring the numbers match, and tighten the nuts to the specified torque (photo).

20 Refit the cylinder head and oil sump as described in earlier Sections.

21 Refill the engine with oil and coolant.

2 Disconnect the battery and remove it together with its support bracket.

3 Remove the air cleaner.

4 Drain the cooling system, retaining the coolant if it is suitable for further use.

5 Remove the radiator complete with electric cooling fan (see Chapter 2).

6 If power steering is fitted, unbolt the pump and move it to one side of the engine compartment.

7 If air conditioning is fitted, unbolt the compressor and belt tensioner pulley and move them aside. *Do not disconnect the refrigerant circuit pipelines* (see Chapter 11).

8 Disconnect the exhaust downpipe from the manifold and the mounting bracket.

9 Unbolt and disconnect the gearchange control rod and its stabiliser rod from the transmission.

10 Support the vehicle under its side-member and then disconnect the front suspension lower balljoints. Do this by unscrewing the three nuts which hold the balljoint to the suspension arm. It is recommended that new nuts are used at reassembly.

11 Remove the front roadwheels.

12 Drain the engine and transmission oils.

13 Unbolt the disc calipers and tie them up out of the way.

14 Unscrew, but do not remove, the nuts at the front suspension strut top mountings. This is to allow movement of the struts when the driveshafts are withdrawn from the transmission.

15 To disconnect a driveshaft, insert a large screwdriver or suitable lever behind the inboard joint flange and prise to overcome the resistance of the joint circlip. Take care not to damage the transmission oil seal and do not pull on the outer end of the driveshaft or the joints may come apart. Insert a rod into the side gears in the transmission casing to prevent them moving from the differential case.

16 Disconnect the clutch operating cable from the release lever.

17 Disconnect the speedometer drive cable from the transmission.

18 Disconnect the throttle and choke cables as applicable.

19 Disconnect the fuel hoses from the fuel pump and plug them. Also disconnect all vacuum and air hoses from the engine.

20 Disconnect all electrical leads, including those from the coolant temperature switch, oil pressure switch, reverse lamp switch and alternator, also the HT and LT leads from the ignition coil.

21 On models with an automatic choke, disconnect the electrical lead from the choke terminal. Withdraw the complete wiring harness from under the intake manifold after releasing the clips.

22 Lifting eyes should be bolted to the engine. Attach suitable lifting gear and take the weight of the engine.

23 Disconnect the four engine/transmission flexible mountings by

## 12 Engine removal – method

The engine should be removed from the vehicle as a unit complete with transmission. The help of an assistant will definitely be required.

### For vehicles with air conditioning

If components of the air conditioning system obstruct the overhaul of the engine and cannot be moved sufficiently within the limits of their flexible hoses to avoid such obstruction, the system should be discharged by your dealer or competent refrigeration engineer.

As the system must be completely evacuated before recharging, the necessary vacuum equipment to do this is only likely to be held by your dealer.

The refrigerant fluid is Freon 12 and, although harmless under normal conditions, contact with eyes or skin must be avoided. If Freon comes into contact with a naked flame a poisonous gas is created which is injurious to health.

## 13 Engine/manual transmission – removal and separation

Refer to Chapter 6 where necessary

1 With the help of an assistant, unbolt and remove the bonnet (see Chapter 11).

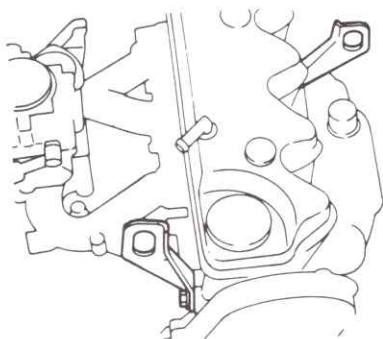


Fig. 1.11 Engine lifting brackets (Sec 13)

unscrewing either the bush pivot or the nut according to location (photos).

24 Lift the engine/transmission up and out of the engine compartment (photo). Take care not to damage adjacent components or the wing surface.

25 With the unit removed, clean away external dirt using a water soluble solvent or paraffin and a stiff brush.

26 To separate the engine from the transmission unbolt and remove the starter motor and then withdraw the bolts which connect the clutch bellhousing to the engine. Note that some of these bolts retain the upper coolant tube, the sump pan-to-bellhousing reinforcement tube and the transmission mounting brackets. Mark their positions for ease of refitting.

27 Support the weight of the transmission and then withdraw it in a straight line from the engine.

A/T models

M/T models

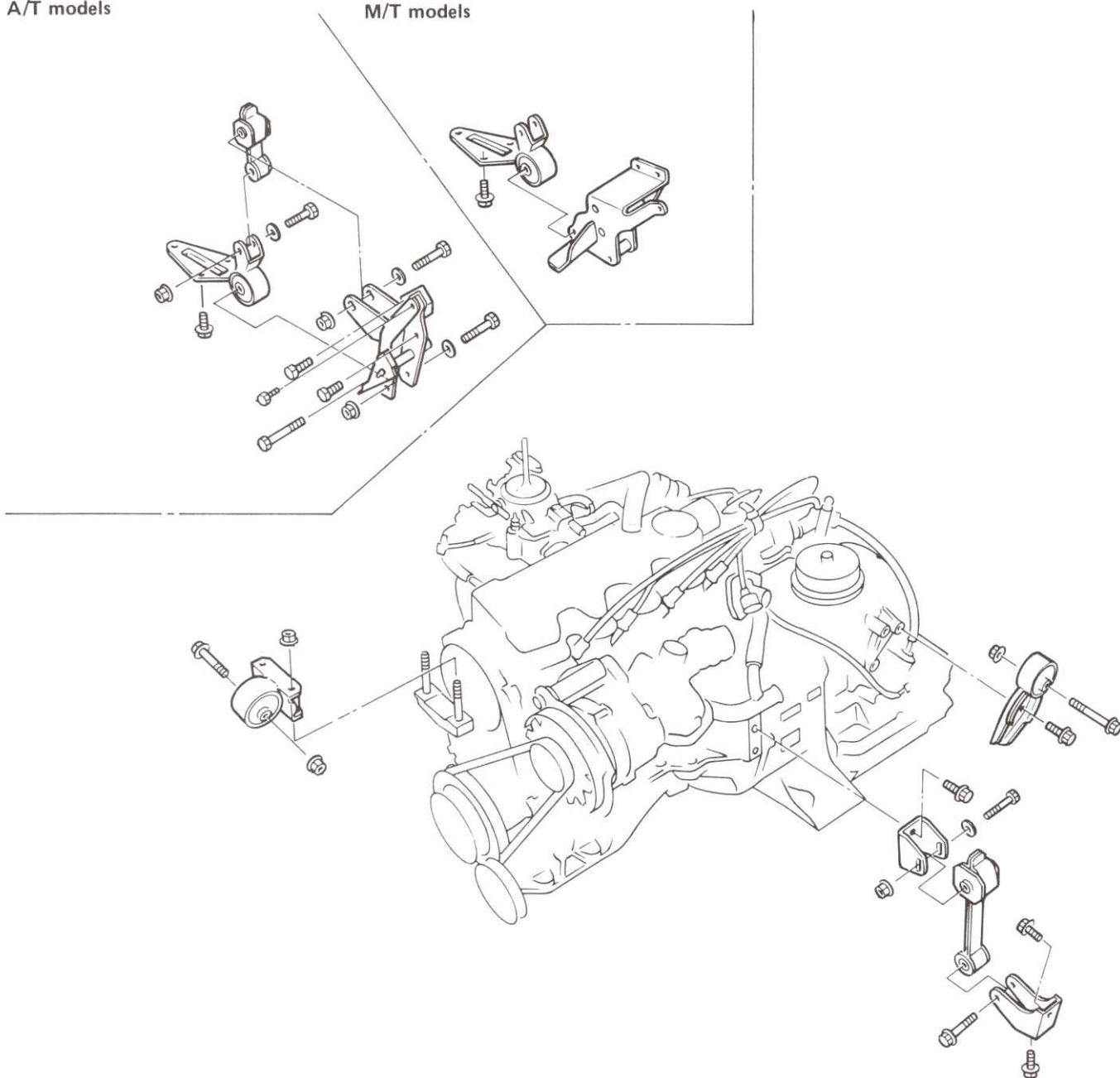
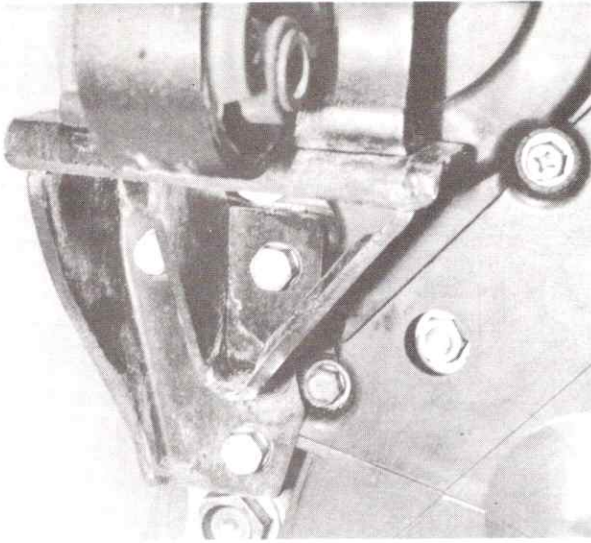
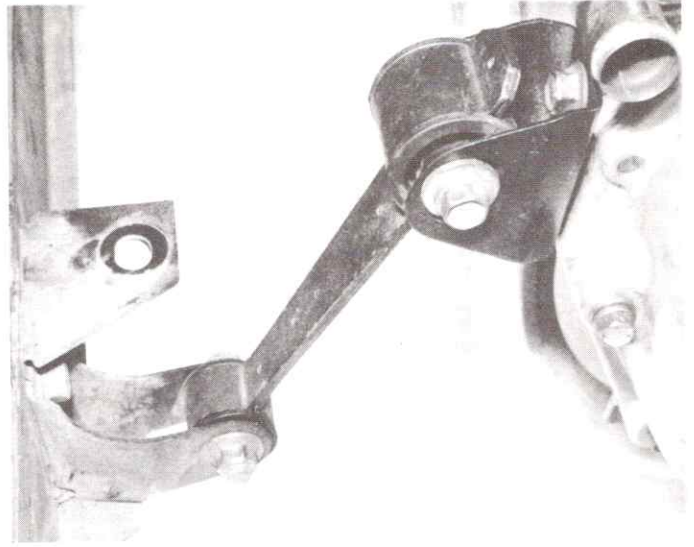


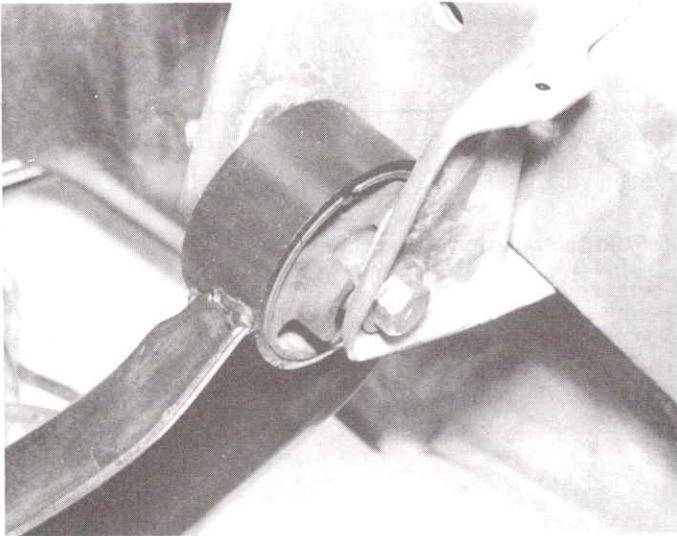
Fig. 1.12 Engine mounting brackets (Sec 13)



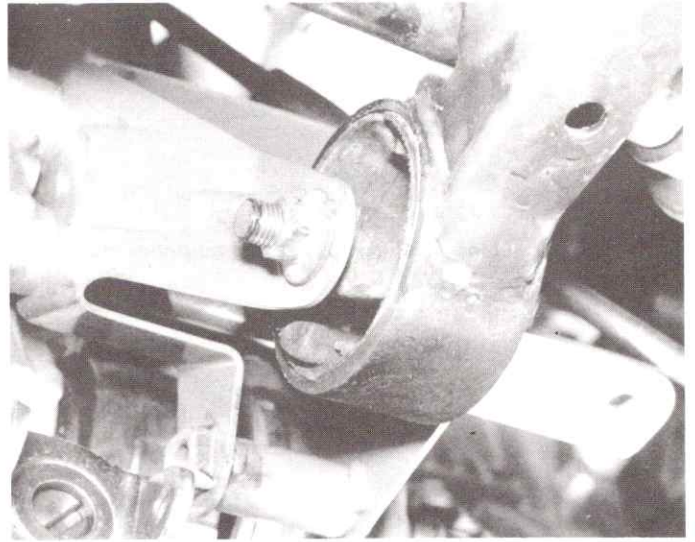
13.23A Left-hand engine mounting



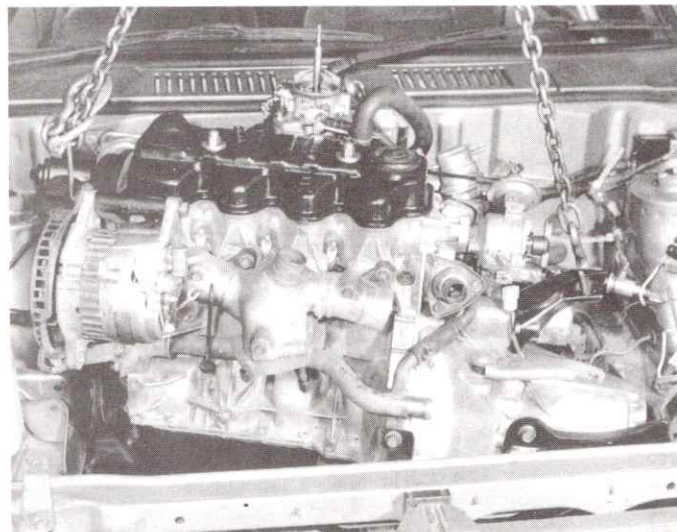
13.23B Front mounting



13.23C Right-hand mounting



13.23D Rear mounting



13.24 Lifting the engine out

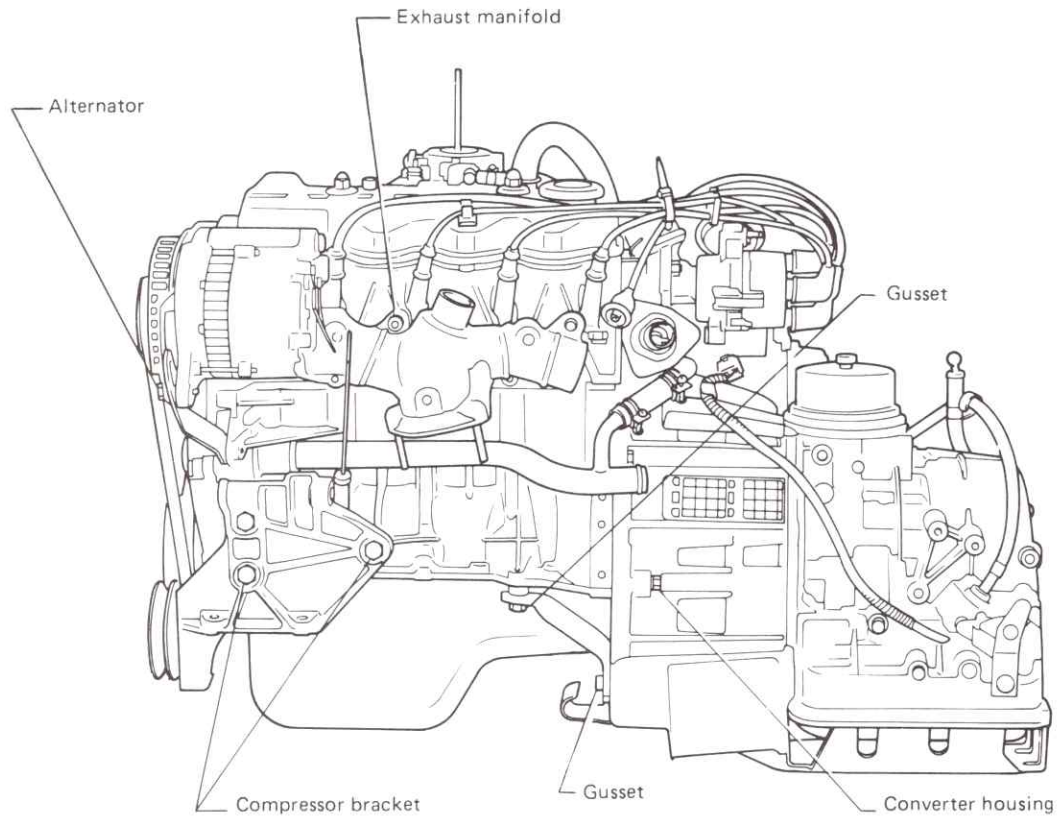


Fig. 1.13 Engine external components viewed from front (automatic version shown) (Sec 13)

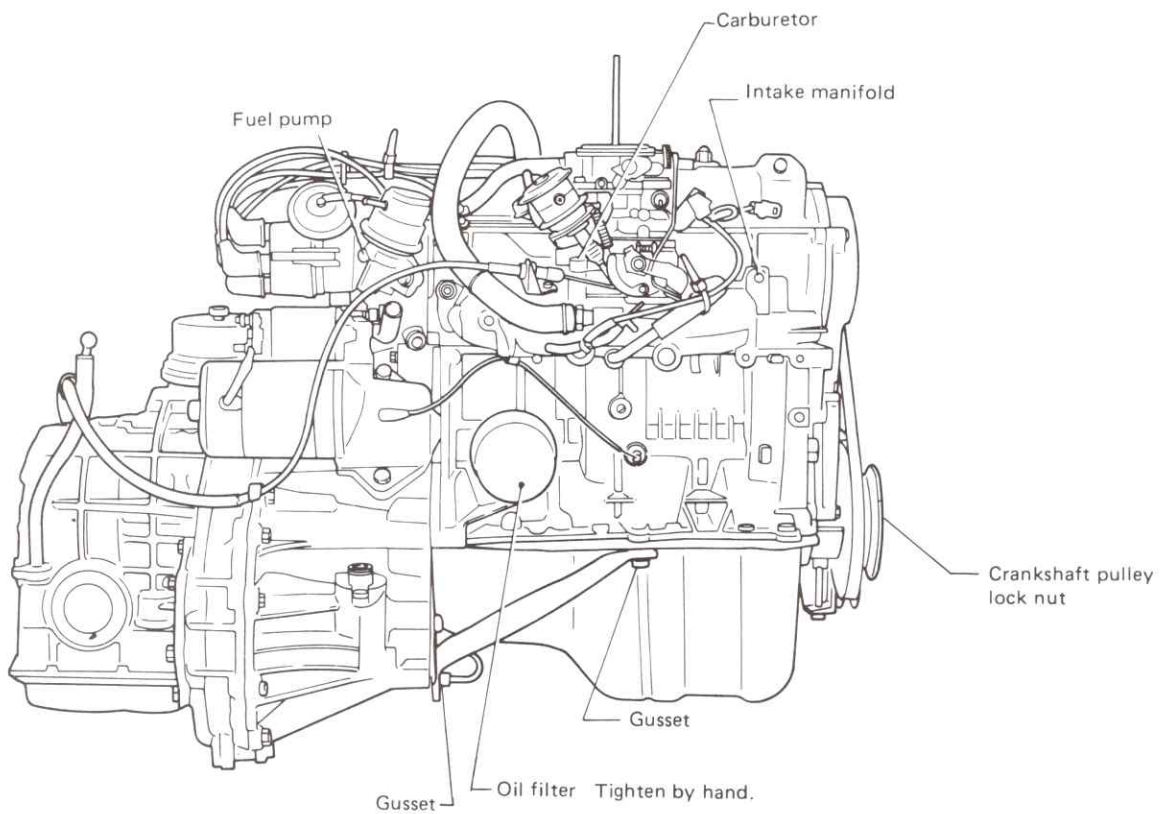


Fig. 1.14 Engine external components viewed from rear (automatic version shown) (Sec 13)

#### 14 Engine/automatic transmission – removal and separation

- 1 The operations for removal are very similar to those described for vehicles with manual transmission in the preceding Section but observe the following differences. Refer also to Chapter 7.
- 2 Ignore any reference to the clutch cable.
- 3 Remove the front wing protective shield where fitted.
- 4 Disconnect the speed selector cable from the transmission, also the inhibitor switch leads.
- 5 Disconnect and plug the oil cooler hoses.
- 6 To separate the engine from the automatic transmission first unbolt and remove the starter motor. Also disconnect the kick-down cable.
- 7 Mark the relationship of the torque converter to the driveplate using a dab of quick-drying paint.
- 8 Unscrew the torque converter-to-driveplate connecting bolts. The crankshaft will have to be turned to bring each bolt into view in the cut-out in the torque converter housing before a spanner or socket wrench can be used. Remove the engine-to-transmission connecting bolts.
- 9 Withdraw the automatic transmission, at the same time have an assistant hold the torque converter in full engagement with the oil pump driveshaft to avoid loss of transmission fluid.

#### 15 Engine dismantling – general

- 1 Before commencing a major engine overhaul, make sure that you have gathered together clean rags, brushes, freeing fluid and a good selection of tools – including a torque wrench.
- 2 A number of clean tins or other containers is useful to keep the various nuts and bolts safely. Mark the tins as a guide to where the fixings belong.
- 3 Have a pencil and paper handy to record sequences of assembly of

small items, or to sketch an item which may present difficulty at reassembly or refitting.

- 4 Obtain all the necessary gaskets and oil seals in advance.
- 5 If it is known that only one component of the engine is worn or damaged the dismantling operations should only be pursued as far as is necessary to rectify the problem, the engine need not be completely dismantled.

#### 16 Engine – complete dismantling

- 1 Place the engine upright, preferably on a bench.
- 2 Remove the ancillary components such as the alternator, distributor, fuel pump, carburettor, inlet and exhaust manifolds, and remove the transmission unit and clutch assembly. (Refer to the relevant Chapter).
- 3 Remove the oil filter.
- 4 Remove the thermostat and housing.
- 5 Remove the alternator mounting bracket. If fitted also remove those for power steering and air conditioner pumps.
- 6 Remove the coolant tube which runs along the side of the engine.
- 7 Remove the timing belt covers.
- 8 Remove the rocker cover.
- 9 Turn the engine on its side and remove the oil sump.
- 10 Prevent the crankshaft from rotating and remove the flywheel bolts. As these bolts are not offset, mark the flywheel and crankshaft relationship before removing the flywheel, and the engine rear plate.
- 11 Remove the timing belt and belt tensioner pulley.
- 12 Remove the camshaft sprocket by inserting a dowel through one of the holes so that it contacts an engine web to prevent it turning while undoing the three bolts (photo).
- 13 Remove the crankshaft sprocket, which is keyed to the crankshaft. Use a puller if it is tight.
- 14 Undo the five bolts and remove the water pump (photo).

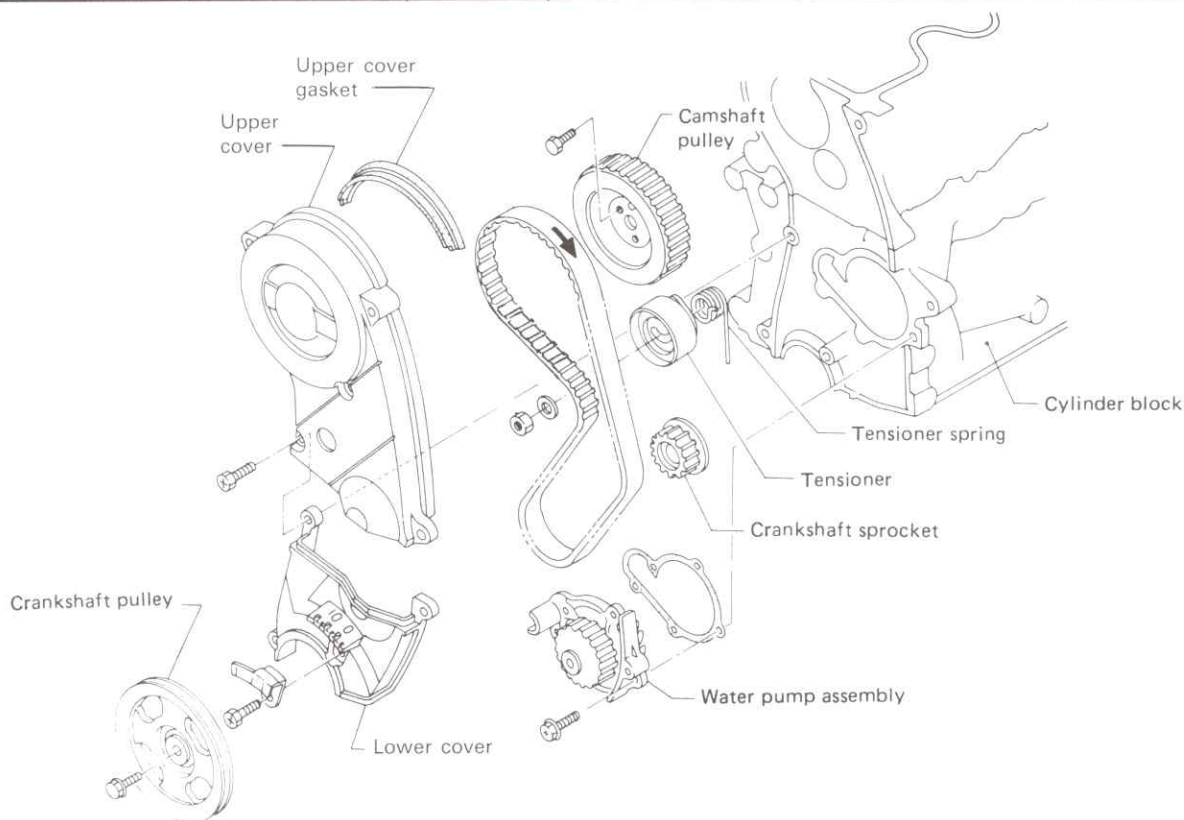
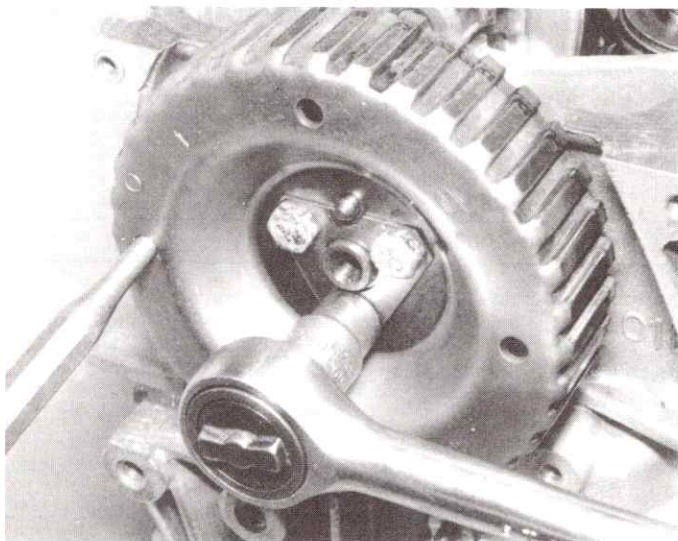
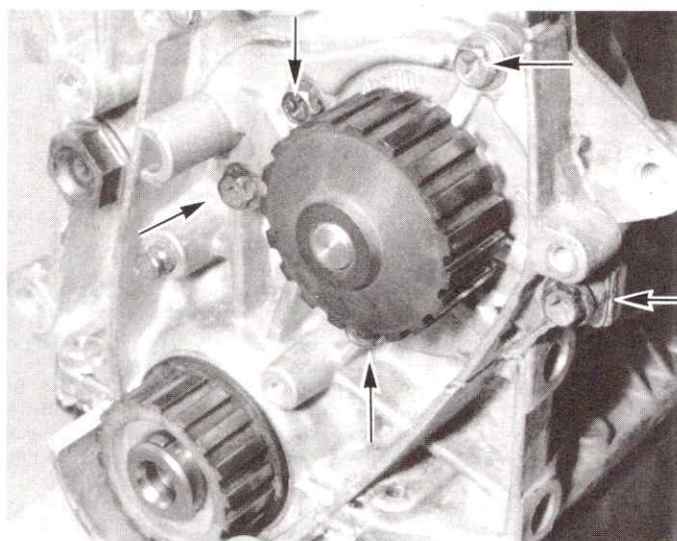


Fig. 1.15 Components of the timing gear (Sec 16)



16.12 Removing the camshaft drive sprocket



16.14 Water pump retaining bolts

15 Remove the oil pump and the oil pump idler gear, and lift out the driveshaft.

16 Remove the cylinder head bolts and lift off the cylinder head and gasket.

17 Remove the piston and con rod assemblies as described in Section 11.

18 Unscrew the main bearing cap bolts progressively and in sequence. Remove the main bearing cap.

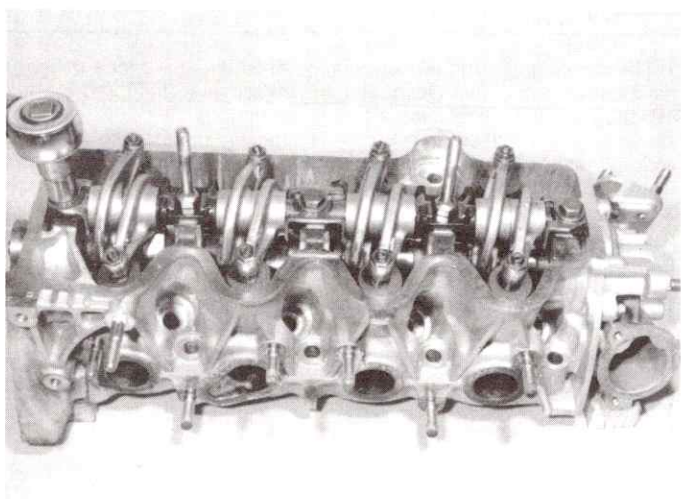
19 Lift out the crankshaft, keeping the bearings in their correct order, and note the thrust washers either side of the No 4 bearing.

20 The engine is now ready for inspection as described in the following Sections.

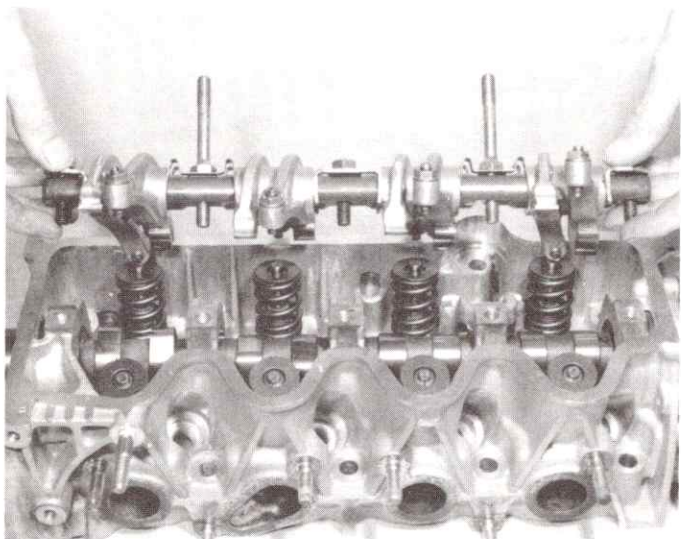
### 17 Cylinder head – dismantling and decarbonizing

1 Remove the bolts securing the rocker shaft assembly to the cylinder head and remove the shaft and rockers. Note which way it fits for correct reassembly (photos). Note where the spring locking clips are fitted over the bolts.

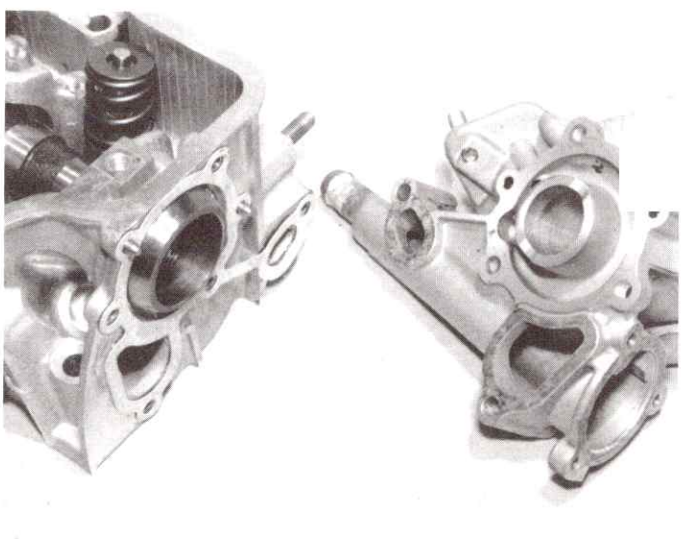
2 Remove the bolts from the thermostat housing on the end of the cylinder head and remove the housing (photo).



17.1A Removing the rocker shaft retaining bolts ...



17.1B ... and the rocker shaft assembly



17.2 Removing the thermostat housing

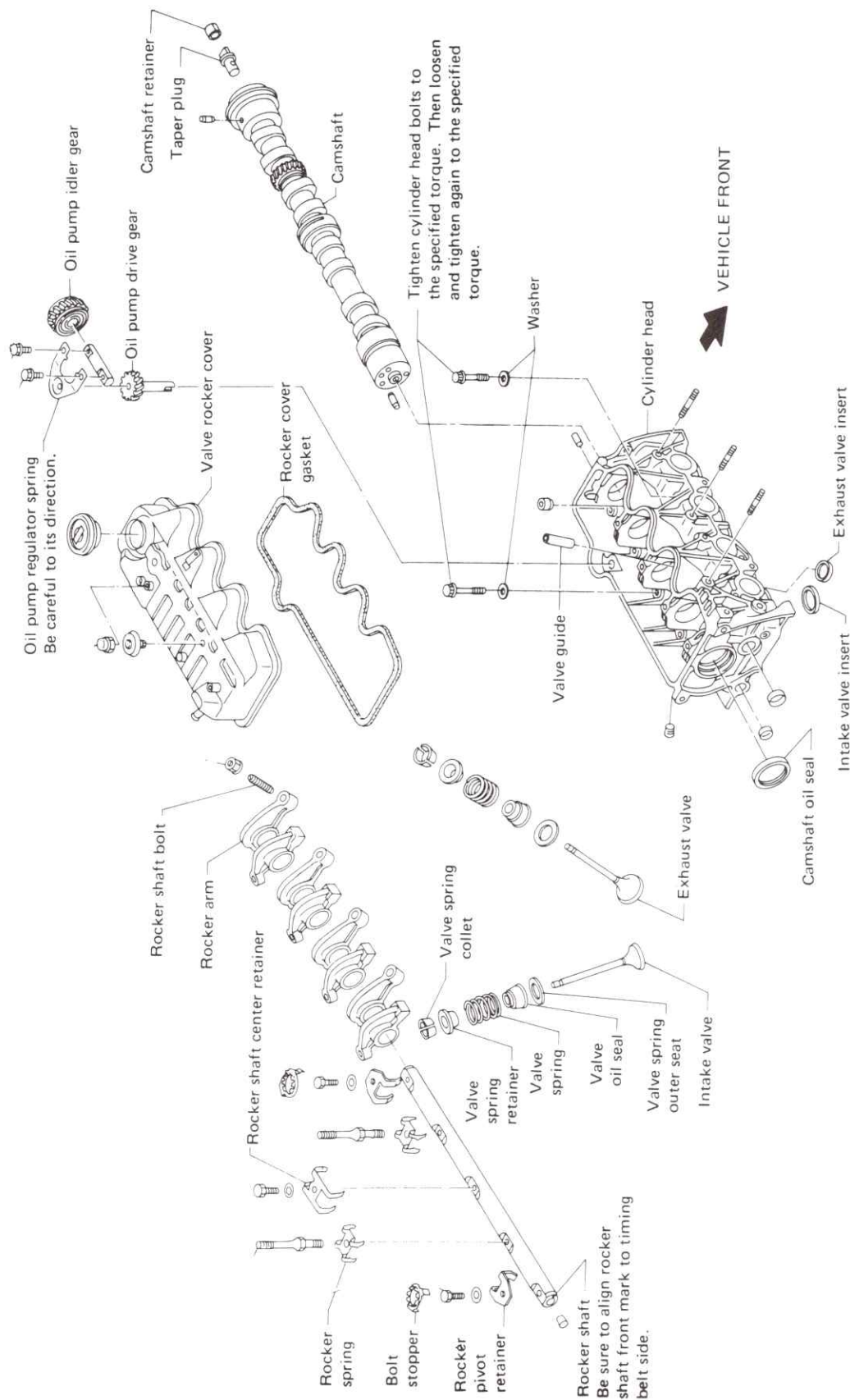
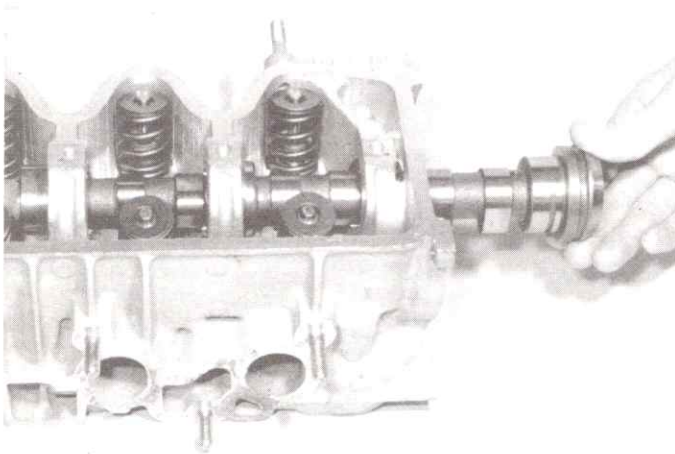


Fig. 1.16 Exploded view of cylinder head (Sec 17)



17.3 Withdrawing the camshaft

3 Carefully withdraw the camshaft, taking care not to damage the bearings as the lobes pass through (photo).

4 The valves and their associated components should now be removed. Owing to the depth of the cylinder head a valve spring compressor having a long reach will be required. If this is not available, temporarily refit the rocker shaft and then make up a lever with a fork at one end to compress the valve spring by using the underside of the rocker shaft as a fulcrum.

5 Compress the first valve spring, extract the split collets. If the valve spring refuses to compress, do not apply excessive force but remove the compressor and place a piece of tubing on the spring cap and strike it a sharp blow to release the collets from the valve stem. Refit the compressor and resume operations.

6 Gently release the compressor, take off the spring retaining cap, the valve spring and the spring seat. Remove the valve. Keep the valve with its associated components together and in numbered sequence so that it can be refitted in its original position. A small box with divisions is useful for this purpose.

7 Remove the other valves in a similar way.

8 Bearing in mind that the cylinder head is of light alloy construction and is easily damaged use a blunt scraper or rotary wire brush to clean all traces of carbon deposits from the combustion spaces and the ports. The valve heads, stems and valve guides should also be freed from any carbon deposits. Wash the combustion spaces and ports down with a suitable solvent and scrape the cylinder head surface free of any foreign matter with the side of a steel rule, or a similar article.

9 If the engine is installed in the car, clean the pistons and the top of the cylinder bores. If the pistons are still in the block, then it is essential that great care is taken to ensure that no carbon gets into the cylinder bores as this could scratch the cylinder walls or cause damage to the piston and rings. To ensure this does not happen, first turn the crankshaft so that two of the pistons are at the top of their bores. Stuff rag into the other two bores or seal them off with paper and masking tape. The waterways should also be covered with small pieces of masking tape to prevent particles of carbon entering the cooling system and damaging the coolant pump.

10 Press a little grease into the gap between the cylinder walls and the two pistons which are to be worked on. With a blunt scraper carefully scrape away the carbon from the piston crown, taking great care not to scratch the aluminium. Also scrape away the carbon from the surrounding lip of the cylinder wall. When all carbon has been removed, scrape away the grease which will now be contaminated with carbon particles, taking care not to press any into the bores. To assist prevention of carbon build-up the piston crown can be polished with a metal polish. Remove the rags or masking tape from the other two cylinders and turn the crankshaft so that the two pistons which were at the bottom are now at the top. Place rag in the cylinders which have been decarbonized, and proceed as just described.

11 Examine the head of the valves for pitting and burning, especially the heads of the exhaust valves. The valve seatings should be examined at the same time. If the pitting on the valve and seat is very slight, the marks can be removed by grinding the seats and valves together with coarse, and then fine valve grinding paste (photo).

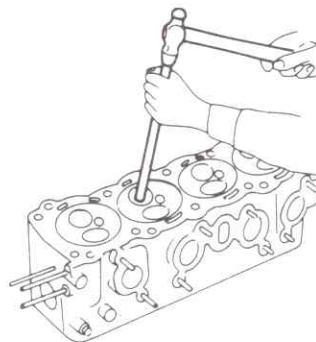


Fig. 1.17 Removing a valve guide (Sec 17)

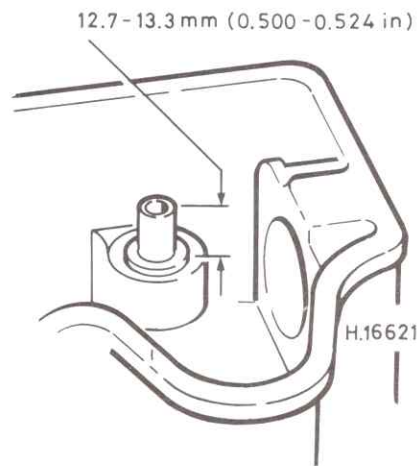
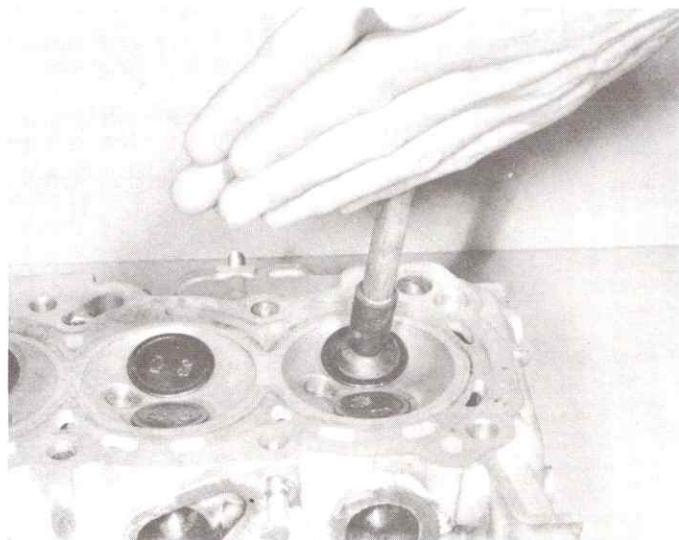


Fig. 1.18 Valve guide projection (Sec 17)



17.11 Grinding in a valve seat

12 Where bad pitting has occurred to the valve seats it will be necessary to recut them and fit new valves. This latter job should be entrusted to the local agent or engineering works. In practice it is very seldom that the seats are so badly worn. Normally it is the valve that is too badly worn for refitting, and the owner can easily purchase a new set of valves and match them to the seats by valve grinding.

13 Valve grinding is carried out as follows. Smear a trace of coarse carborundum paste on the seat face and apply a suction grinding tool to the valve head. With a semi-rotary motion, grind the valve head to its seat, lifting the valve occasionally to redistribute the grinding paste. When a dull matt even surface is produced on both the valve seat and the valve, wipe off the paste and repeat the process with fine carborundum paste, lifting and turning the valve to redistribute the paste as before. A light spring placed under the valve head will greatly ease this operation. When a smooth unbroken ring of light grey matt finish is produced on both valve and valve seat faces, the grinding operation is complete. Carefully clean away every trace of grinding compound, take great care to leave none in the ports or in the valve guides. Clean the valves and valve seats with a solvent-soaked rag, then with a clean rag, and finally, if an air line is available, blow the valves, valve guides and valve ports clean.

14 Check that all valve springs are intact. If any one is broken, all

should be renewed. Check the free height of the springs against new ones. If some springs are not within specifications, replace them all. Springs suffer from fatigue and it is a good idea to renew them even if they look serviceable.

15 Check that the oil supply holes in the rocker arms are clear.

16 The cylinder head can be checked for warping either by placing it on a piece of plate glass or using a straight-edge and feeler blades. If there is any doubt or if its block face is corroded, have it re-faced by your dealer or motor engineering works.

17 Test the valves in their guides for side-to-side rock. If this is any more than almost imperceptible, new guides must be fitted. This, as with valve seat renewal, is really a job for your dealer as the cylinder head must be warmed and the old guide driven out. New guides should be pressed in to protrude 12.7 mm (0.50 in) above the cylinder head and then reamed using a 7.005 to 7.020 mm (0.2758 to 0.2764 in) reamer.

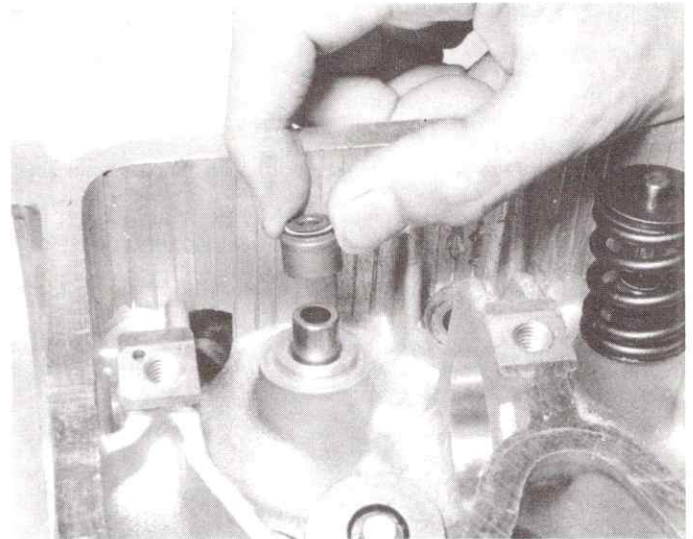
18 Renew the valve stem oil seals (photos).

19 Commence reassembly by oiling the stem of the first valve and pushing it into its guide (photo).

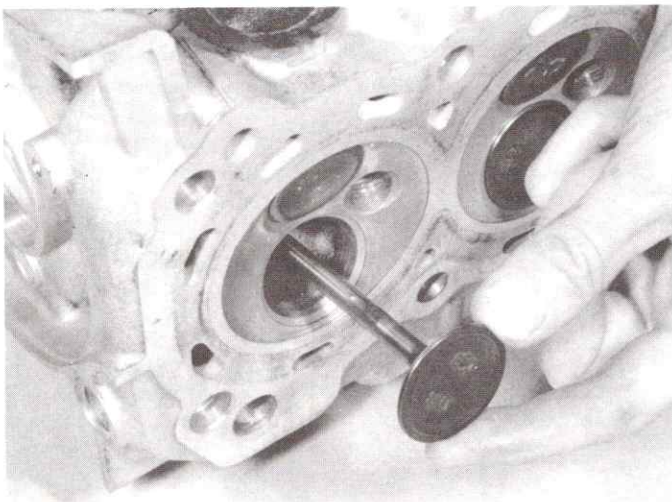
20 Fit the spring seat (photo), the valve spring (photo) and the spring cap (photo). The closer coils of the valve spring must be towards the cylinder head.



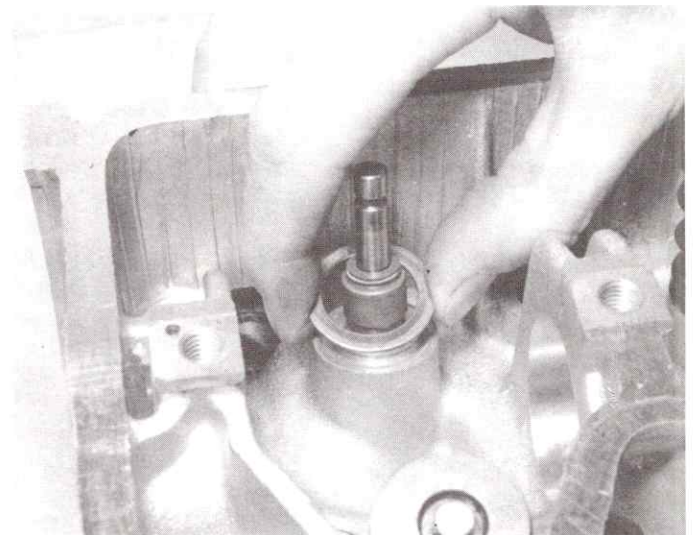
17.18A Components of the valve



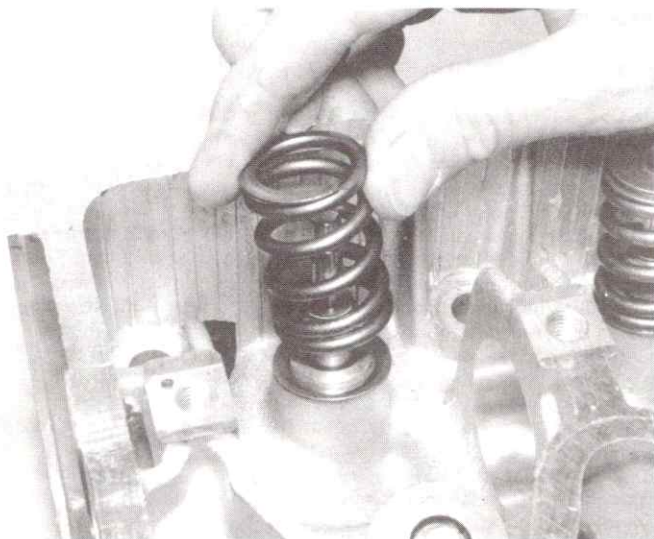
17.18B Fitting valve stem oil seal



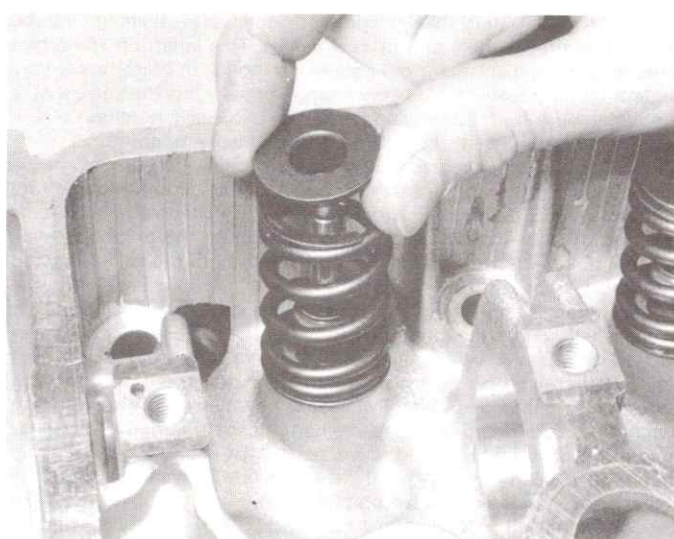
17.19 Pushing in a valve



17.20A Fitting the spring seat ...



17.20B ... spring ...



17.20C ... and cap

21 Compress the valve spring and locate the split collets in the valve stem cut-outs (photo).

22 Gently release the compressor, checking to see that the collets are not displaced (photo).

23 Fit the remaining valves in the same way (photo).

24 Tap the end of each valve stem with a plastic or copper-faced hammer to settle the components.

25 Fit a new camshaft oil seal to the cylinder head, spring faces

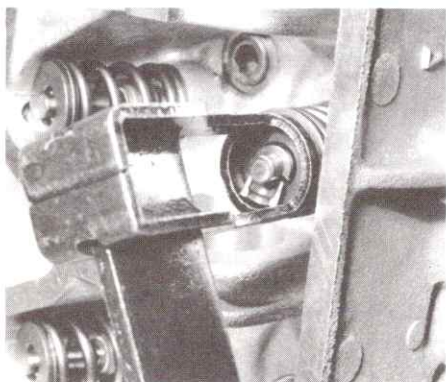
inwards (photo). Oil all bearing surfaces and the camshaft, and insert the camshaft into the cylinder head.

26 For correct valve timing, the spigot should be centralised at the top. Fit the camshaft retainer at the other end of the camshaft.

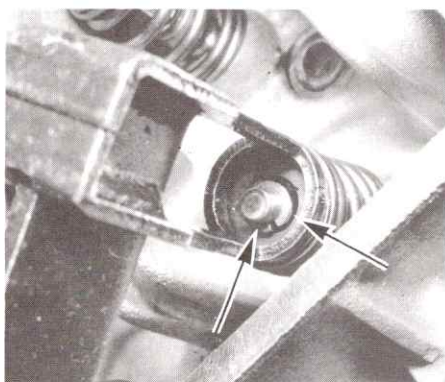
27 Fit a new gasket to the thermostat housing, apply sealant to the mating surfaces, and bolt the housing in position on the cylinder head.

28 Fit the camshaft sprocket (photo).

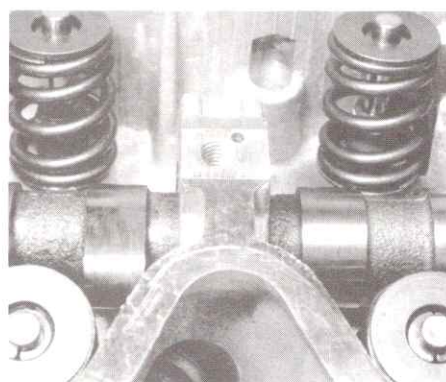
29 Before refitting the rocker shaft and arms, check the shaft for wear



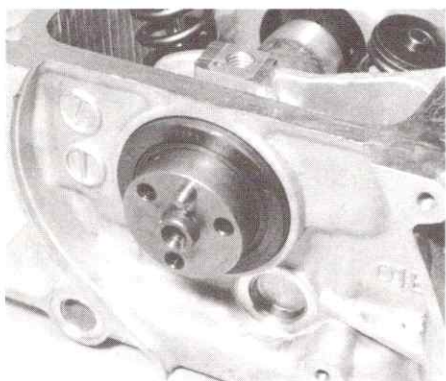
17.21 Using a valve spring compressor



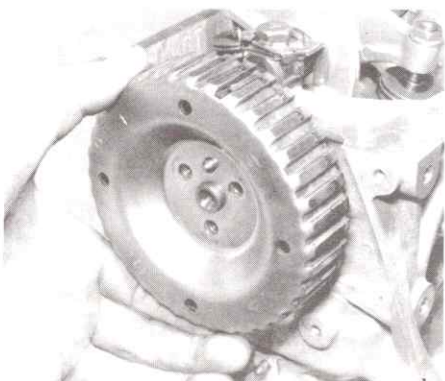
17.22 Check the collets are in position before releasing the compressor



17.23 Valve stems and springs assembled



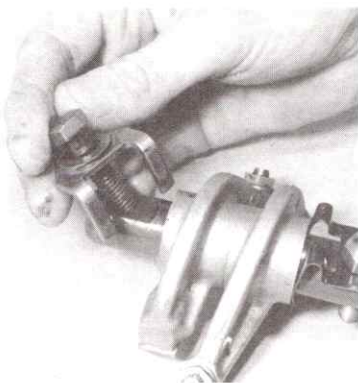
17.25 Camshaft oil seal in position



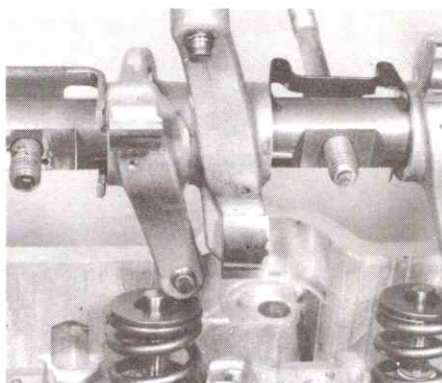
17.28 Camshaft sprocket correctly located



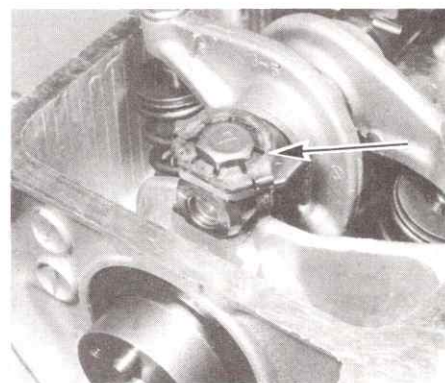
17.29 Put all parts back in their original positions



17.30A Pivot retainer legs face inwards



17.30B Refitting the rocker arm assembly



17.30C Don't forget the spring locking washers

and the rocker arms for pitting of the case hardened contact points with the valve stems. Keep all parts in order, and replace in their original positions (photo).

30 Refit the rocker shaft, making sure the legs of the pivot retainers face inwards, and use new sprung locking washers on the bolt heads. These push on after the bolts have been tightened (photos).

## 18 Examination and renovation

### *Cylinder block and crankcase*

- 1 Examine the casting carefully for cracks, especially around the bolt holes and between cylinders.
- 2 The cylinder bores must be checked for taper, ovality, scoring and scratching. Start by examining the top of the cylinder bores. If they are worn, a ridge will be felt on the thrust side. This ridge marks the top of piston travel. The owner will have a good indication of bore wear prior to dismantling by the quantity of oil consumed and the emission of blue smoke from the exhaust, especially when the engine is cold.
- 3 An internal micrometer or bore gauge should be used to check bore wear and taper.
- 4 Slight wear and scoring may be taken out by honing, and the appropriate size piston selected from the five grades shown in the Specifications in the Supplement (Chapter 13).
- 5 If the degree of wear is such that it cannot be rectified by honing, the cylinders can be rebored. Refer to the Supplement (Chapter 13) for details.
- 6 Excessive oil consumption may also be eliminated by fitting proprietary oil control rings, as described in Section 11.

### *Crankshaft and bearings*

- 7 Examine the surfaces of the crankpins and journals for signs of scoring or scratching, and check for ovality or taper. If a crankpin or journals are not within the dimensional tolerances given in the Specifications Section at the beginning of this Chapter the crankshaft will have to be reground.
- 8 Wear in a crankshaft can be detected while the engine is running. Big-end bearing and crankpin wear is indicated by distinct metallic knocking, particularly noticeable when the engine is pulling from low engine speeds. Low oil pressure will also occur.
- 9 Main bearing and journal wear is indicated by engine rumble increasing in severity as the engine speed increases. Low oil pressure will again be an associated condition.
- 10 Crankshaft grinding should be carried out by specialist engine reconditioners who will supply the matching undersize bearing shells to give the required running clearance.
- 11 Inspect the connecting rod big-end and main bearing shells for signs of general wear, scoring, pitting and scratching. The bearings should be matt grey in colour. If a copper colour is evident, then the bearings are badly worn and the surface material has worn away to expose the underlay. Renew the bearings as a complete set.
- 12 At the time of major overhaul it is worthwhile renewing the bearing

shells as a matter of routine even if they appear to be in reasonably good condition.

13 Bearing shells can be identified by the marking on the back of the shell. Standard sized shells are usually marked STD or 0.00. Undersized shells are marked with the undersize, such as 0.25 mm.

### *Connecting rods*

- 14 Check the alignment of the connecting rods visually. If you suspect distortion, have them checked by your dealer or engine reconditioner on the special jig which he will have.
- 15 The gudgeon pin is an interference fit in the connecting rod small-end and removal or refitting and changing a piston is a job best left to your dealer or engine reconditioner due to the need for a press and jig.

### *Pistons and piston rings*

- 16 Before refitting pistons and connecting rod assemblies, ensure that the oil hole in the connecting rod is on the same side of the piston as the front facing mark on the piston crown (see photo 11.16).
- 17 Removal and refitting of piston rings is covered in Section 11.

### *Flywheel*

- 18 Check the clutch mating surface of the flywheel. If it is deeply scored (due to failure to renew a worn driven plate) then it should be renewed. Slight roughness may be smoothed with fine emery cloth.
- 19 If lots of tiny cracks are visible on the surface of the flywheel this will be due to overheating caused by slipping the clutch or 'riding' the clutch pedal.
- 20 With a pre-engaged type of starter motor it is rare to find the teeth of the flywheel ring gear damaged or worn, but if they are the ring gear will have to be renewed.
- 21 To remove the ring gear, drill a hole between the roots of two teeth, taking care not to damage the flywheel, and then split the ring with a sharp cold chisel.
- 22 The new ring gear must be heated to between 180 and 220°C (356 and 428°F) which is very hot, so if you do not have facilities for obtaining these temperatures, leave the job to your dealer or engine reconditioner.

### *Driveplate (automatic transmission)*

- 23 Should the starter ring gear on the driveplate require renewal, the driveplate should be renewed complete.

### *Camshaft*

- 24 Examine the camshaft bearings for scoring or pitting. If evident then the complete cylinder head will have to be renewed as the bearings are machined directly in it.
- 25 The camshaft itself should show no marks or scoring on the journal or cam lobe surfaces. Where marks are evident, renew the camshaft or have it reprofiled by a specialist reconditioner.

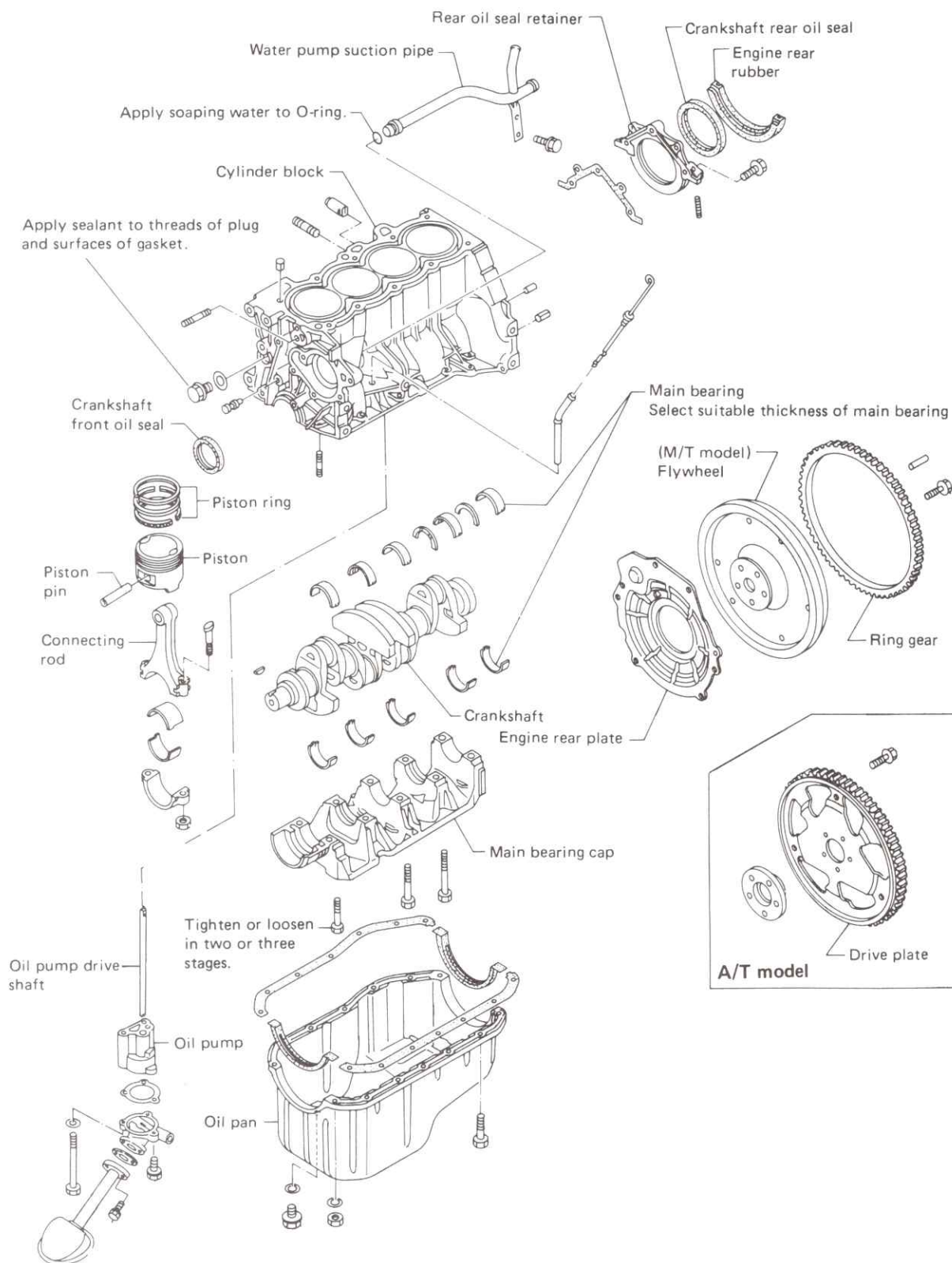


Fig. 1.19 Exploded view of cylinder block (Sec 18)

26 Measure the camshaft journal and bearing diameters. If the journal-to-bearing clearance on bearing 1, 3 or 5 exceeds the specified wear limit, renew components as necessary.

27 **Note:** On later engines the camshaft has been redesigned to drive the oil pump anti-clockwise, and the oil pump and drive have also been changed. Ensure all new parts are compatible.

28 Check the teeth of the camshaft sprocket for wear. Renew the sprocket if necessary.

### Timing belt and tensioner

29 Examine the belt for cracking or fraying and tooth wear. If any of these conditions is evident, or if the belt has been in service for 50 000 miles (80 000 km), it is recommended that it is renewed.

30 The tensioner should not be noisy or shaky when turned, and have good spring action. Where these conditions are not met with, renew the tensioner complete.

### Oil seals and gaskets

31 It is recommended that oil seals and gaskets are renewed at overhaul. It is false economy not to do so. Sockets are useful for removing and fitting seals. An arrow may be stamped on the end to indicate the rotational direction of the component which it seals. Fit seals the correct way round, complying with the arrow. This is usually with the spring facing into the housing into which the seal is being fitted.

### Cylinder head

32 It is dealt with in Section 17, during dismantling and decarbonizing.

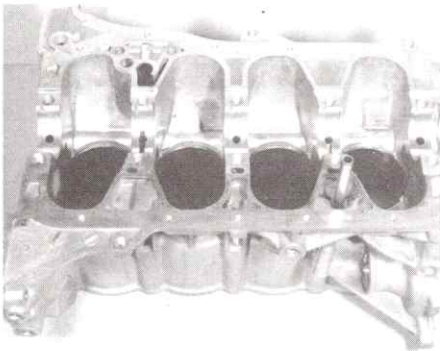
everything must be spotlessly clean, all the oilways must be clear, locking washers and spring washers must always be fitted where indicated and all bearing and other working surfaces must be thoroughly lubricated during assembly.

2 Before assembly begins renew any bolts or studs, the threads of which are in any way damaged, and wherever possible use new spring washers.

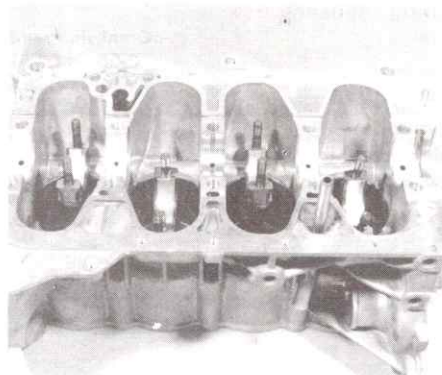
3 Apart from your normal tools, a supply of clean rag, an oil can filled with engine oil (an empty plastic detergent bottle thoroughly cleaned and washed out, will do just as well), a new supply of assorted spring washers, a set of new gaskets, and a torque wrench, should be collected together.

## 20 Engine – reassembly

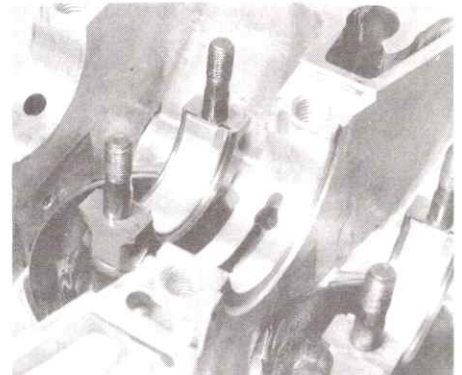
- 1 Place the cleaned cylinder block onto the bench (photo).
- 2 Refer to Section 11 and fit the assembled piston/con rods into their respective cylinders (photo).
- 3 Fit the big-end bearing shells to the con rods (photo).
- 4 Place the main bearing shells on the bench in order, together with the thrust washers. Note that Nos 2 and 4 lower shells are grooved (which fit into the bearing cap) and Nos 2, 3 and 4 upper shells are grooved (which fit into the cylinder block). Also note that the thrust washers fit either side of number 4 bearing (photo).
- 5 Lightly oil the upper shells and fit them into the cylinder block together with the thrust washers (photo).
- 6 Carefully lower the crankshaft into position (photo).
- 7 Draw the piston/con rod assemblies up each cylinder and fit them to the crankshaft as described in Section 11 (photo).
- 8 Fit the main bearing lower shell halves to the main bearing cap, oil all parts liberally, then fit the main bearing cap (photo).
- 9 Before tightening the bolts to their correct torque (see Specifications) and in the sequence shown in Fig. 1.20, bed the crankshaft in by shifting it back and forward axially a few times (photo).



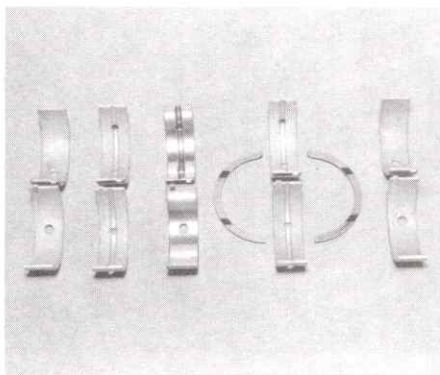
20.1 Cylinder block prior to reassembly



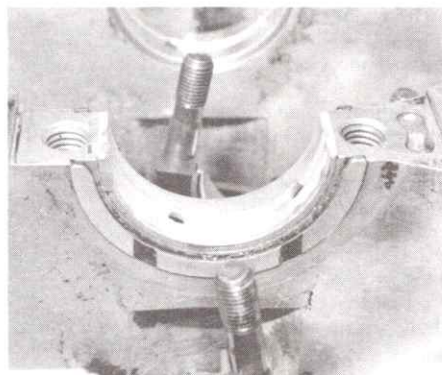
20.2 Cylinder block with piston/con rod assemblies fitted in the bores



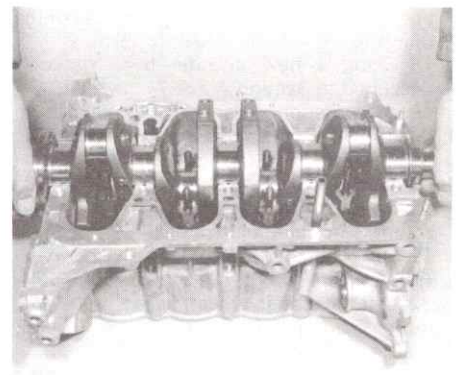
20.3 Big-end shells fitted



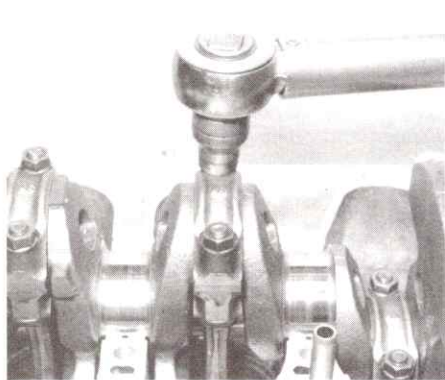
20.4 Main bearing shells and thrust washers



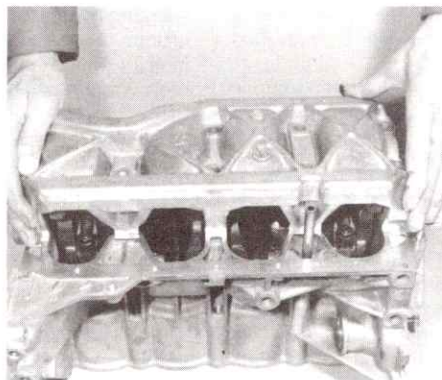
20.5 Main bearing shell and thrust washer fitted to No 4 main bearing



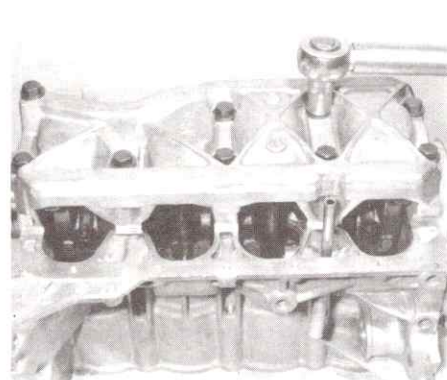
20.6 Lowering the crankshaft into position



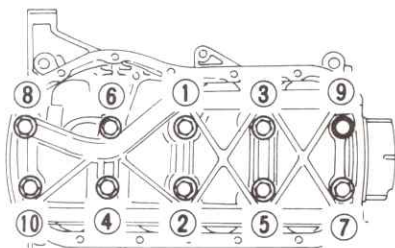
20.7 Tightening the big-end bearing caps



20.8 Fitting the main bearing cap



20.9 Tightening the main bearing cap bolts



**Fig. 1.20 Main bearing cap bolt tightening sequence (Sec 20)**

10 Crankshaft endfloat should now be checked, using a dial gauge, as shown in Fig. 1.21.

11 If the endfloat does not comply with the tolerances given in the Specification, then the thrust washers either side of No 4 main bearing should be changed to bring endfloat within limits.

12 Fit a new oil seal to the crankshaft front end and push it fully home (photos).

13 Fit a new oil seal to the rear crankshaft oil seal housing, fit a new gasket and apply sealing compound to its mating surfaces before bolting on the oil seal and housing (photo).

14 Ensure the oil gallery plug is fitted at the timing belt end of the block (photo).

15 Refit the oil pump as described in Section 9.

16 Apply sealant to the areas indicated in Fig. 1.22 and using a new gasket, fit the oil sump. Make sure the drain plug is fitted to the sump.

17 Apply sealant to the threads of the coolant pump retaining bolts, and to the gasket and mating surfaces of the pump housing, and fit the pump to the cylinder block (photo).

18 Using a new cylinder head gasket, fit the cylinder head as described in Section 4.

19 Also referring to Section 4, fit the oil pump driveshaft, idler gear and retainer. Also fit the camshaft and crankshaft drive sprockets, tensioner assembly and camshaft belt.

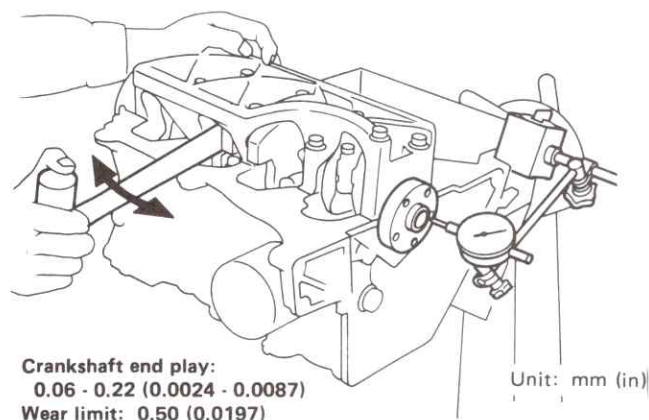
20 Set the valve clearances initially and fit the rocker cover using a new gasket. There is a wire filter mesh over the breather hole. Make sure it is not clogged (photo).

21 Offer up the engine rear shield, fit it over the locating dowels (photo) and keep it in place with one bolt fitted loosely.

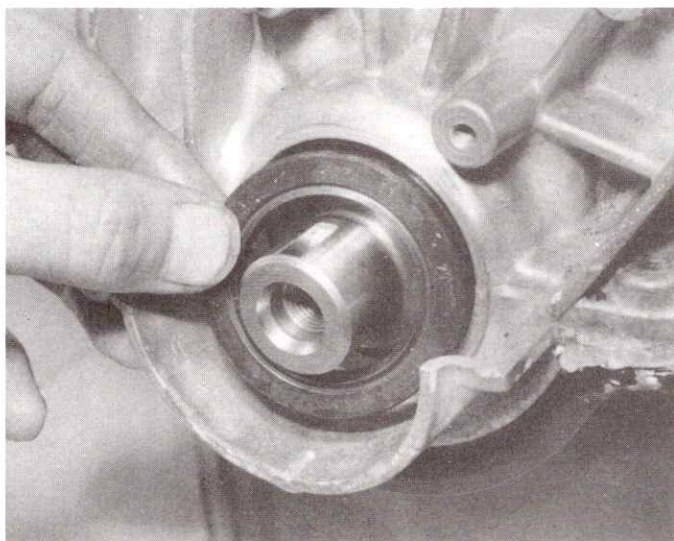
22 Offer up the flywheel, fit the bolts, and ensure that the alignment marks, made previously, match up. Tighten the bolts to the specified torque (photos).

23 Fit the clutch, as described in Chapter 5 (photo).

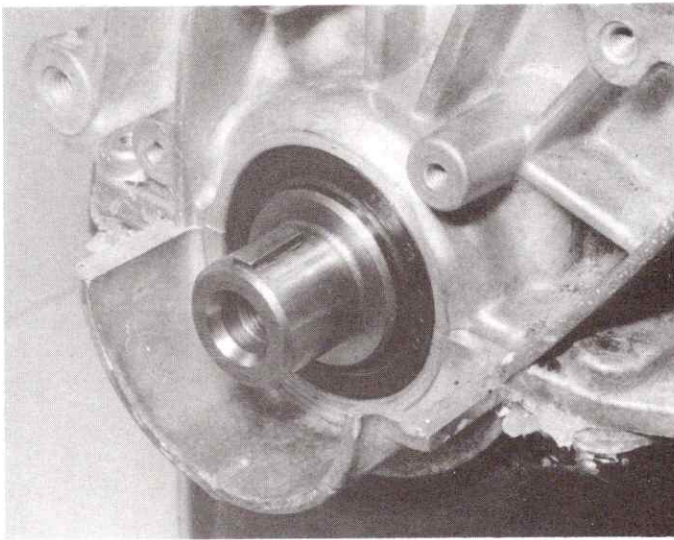
24 Using a new gasket, and with sealant applied to the mating surfaces, fit the thermostat, distributor and fuel pump housing.



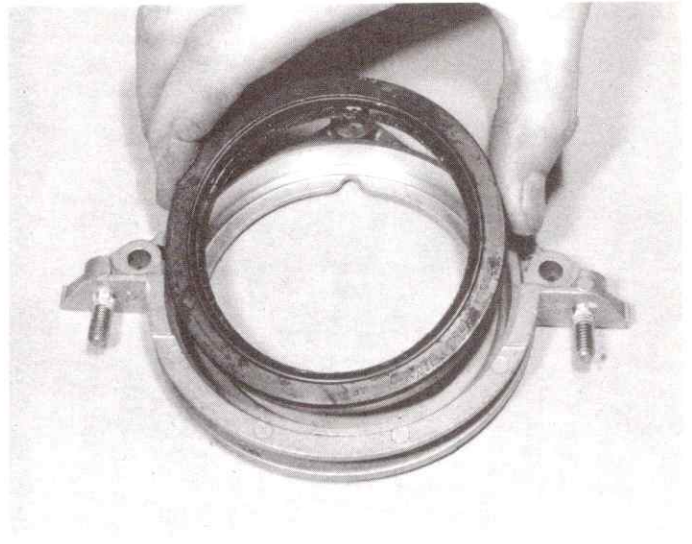
**Fig. 1.21 Using a dial gauge to check crankshaft endfloat (Sec 20)**



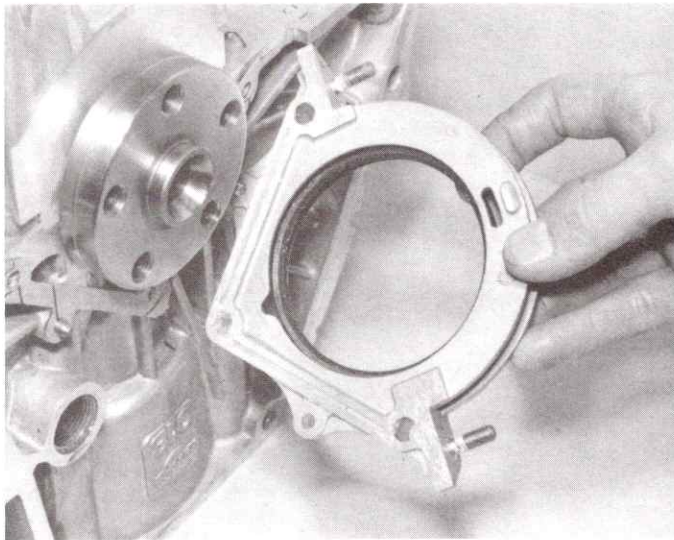
20.12A Fit a new oil seal to crankshaft front end ...



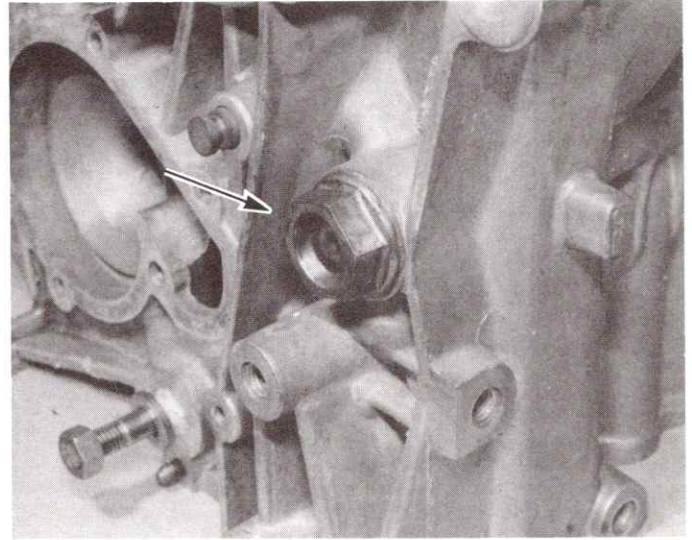
20.12B ... and push it fully home



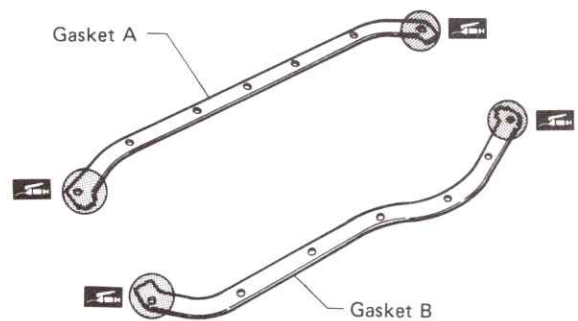
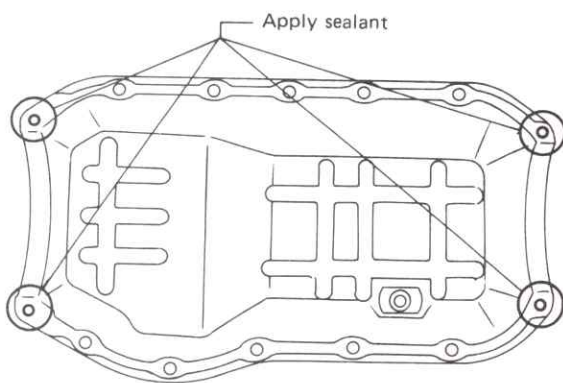
20.13A Fitting an oil seal to the crankshaft rear oil seal housing



20.13B Fitting the oil seal housing to the block

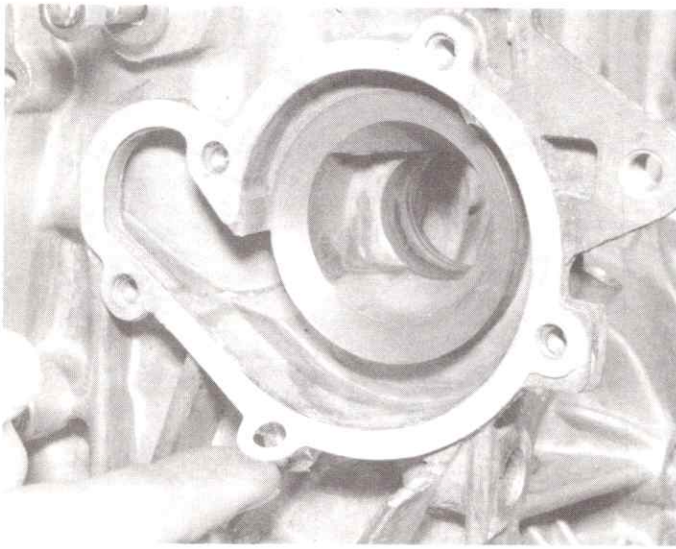


20.14 Oil gallery plug (arrowed)



 : Apply sealant to upper and lower surface of gasket.

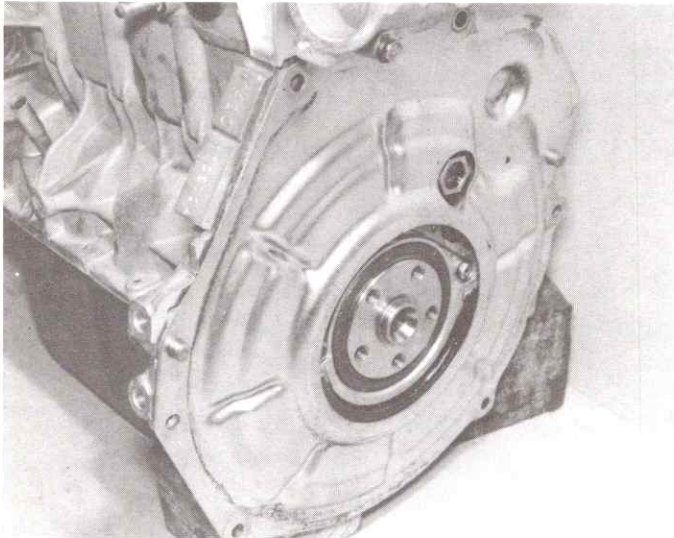
Fig. 1.22 Areas to apply sealant to oil sump gasket (Sec 20)



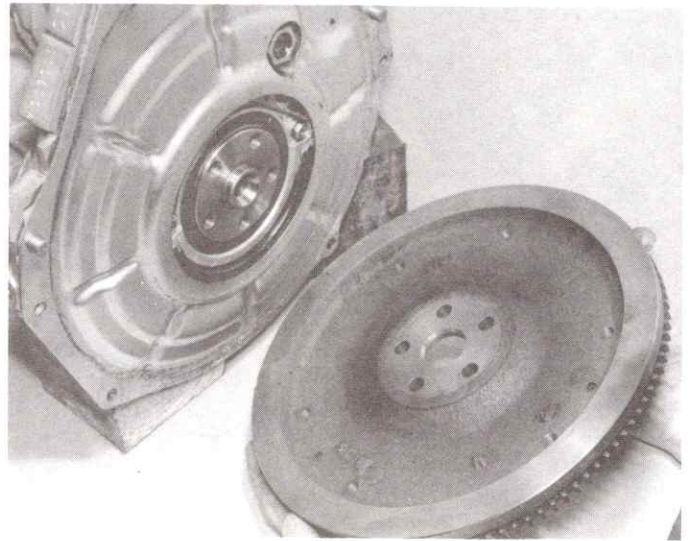
20.17 Fit a new gasket to the water pump housing



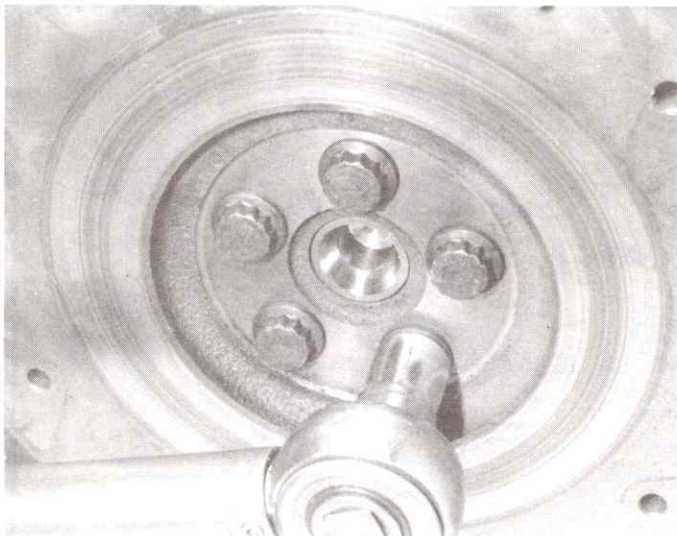
20.20 Wire mesh filter over breather hole



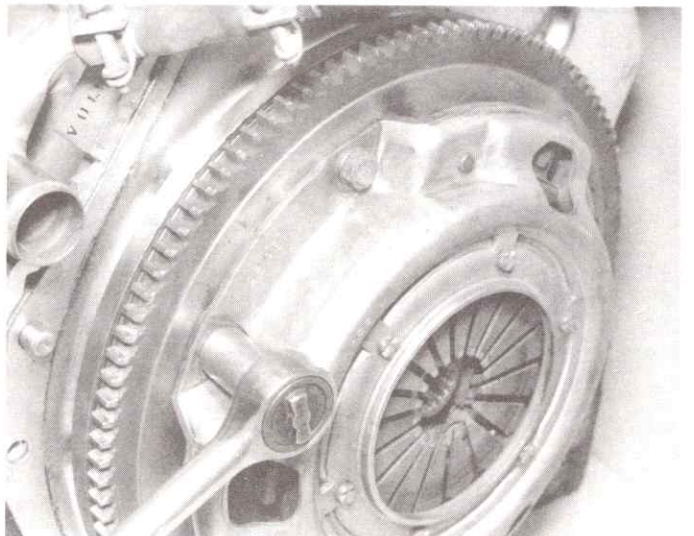
20.21 Fit the rear engine shield



20.22A Offer up the flywheel ...

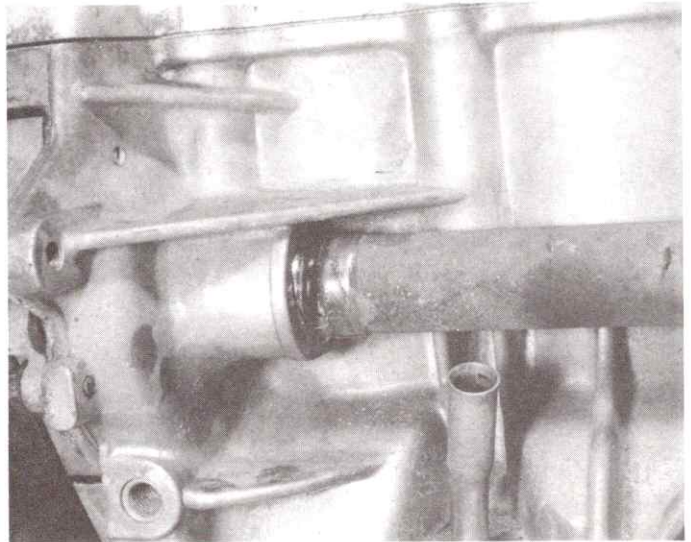


20.22B ... fit and tighten the bolts

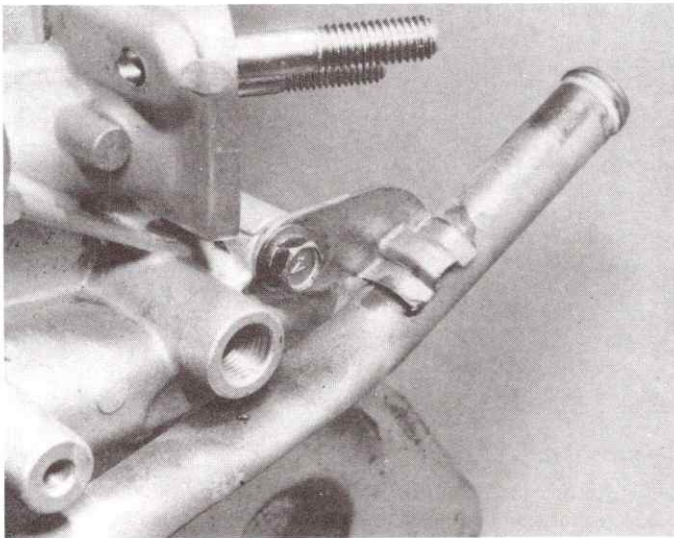


20.23 Bolting on the clutch

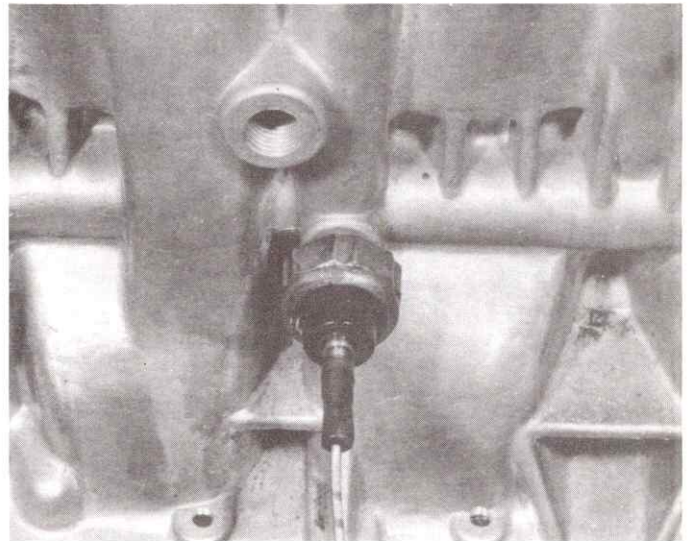
- 25 Using a new O-ring seal fit the coolant pipe to the coolant pump outlet. Lubricate the seal and push it home (photo) and bolt the securing bracket in place below the fuel pump housing (photo).
- 26 Fit the oil pressure switch (photo) and the water temperature sender unit (photo).
- 27 Fit new gaskets to the inlet manifold, then bolt on the manifold. Repeat this procedure with the exhaust manifold and fit the heat collector shield.
- 28 Bolt on the alternator mounting bracket (photo). Fit the timing belt covers if this was not done earlier, then fit the crankshaft pulley.
- 29 Fit the oil filter, smearing the rubber seal with fresh oil to ensure an oil tight seal.
- 30 The ancillaries, such as carburettor and alternator may be fitted now or left until the engine is back in the vehicle.
- 31 Check round the engine to ensure there are no obvious omissions.
- 32 Clean out the inside of the clutch bellhousing then bolt the transmission unit to the engine (refer to Chapter 6 or 7) (photo).
- 33 Fit the starter motor (photo) and tighten its retaining bolts.
- 34 Fit the engine mountings, ensuring any other component brackets are in position (photos). Make sure the engine stays between the oil sump and transmission unit are fitted.
- 35 After a final check the engine transmission unit is ready for installation.



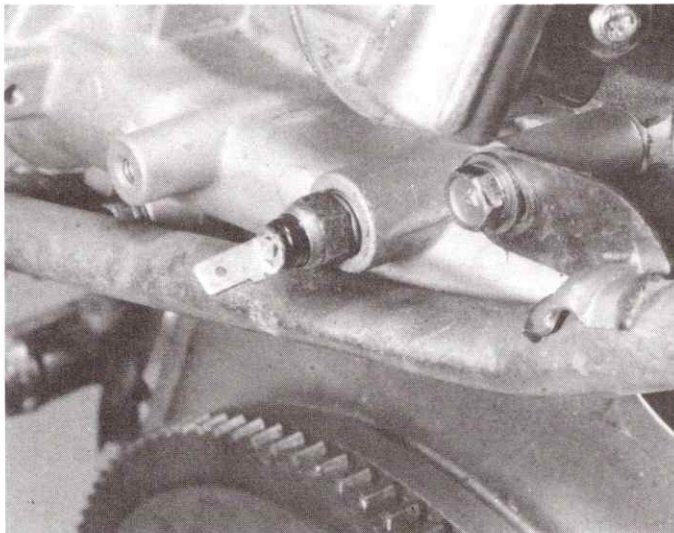
20.25A Use a new O-ring seal ...



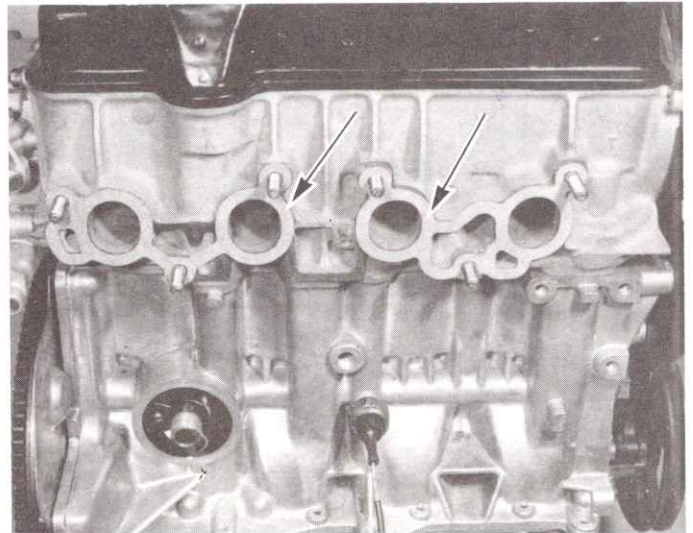
20.25B ... when fitting the coolant pipe



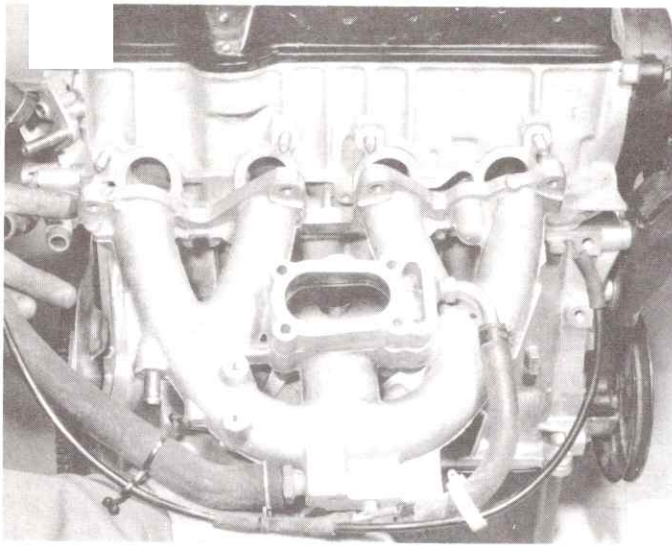
20.26A Oil pressure switch ...



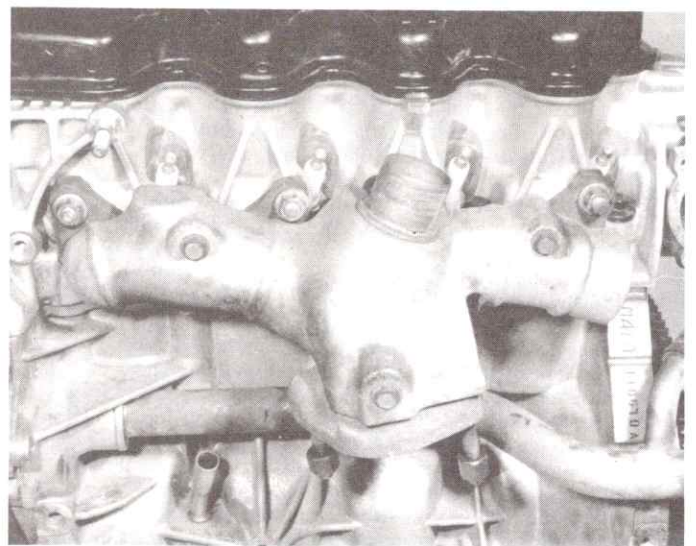
20.26B ... and water temperature transmitter



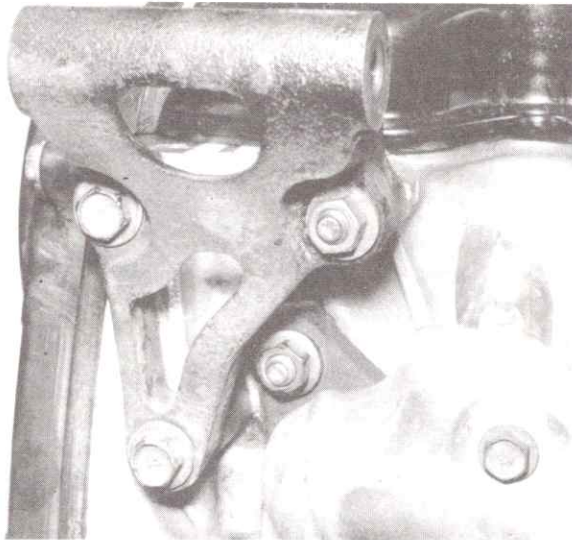
20.27A Use new gaskets ...



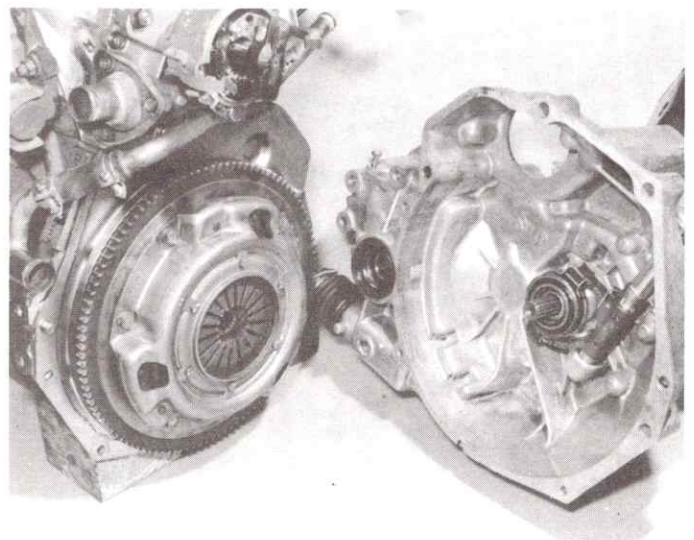
20.27B ... when fitting the inlet manifold ...



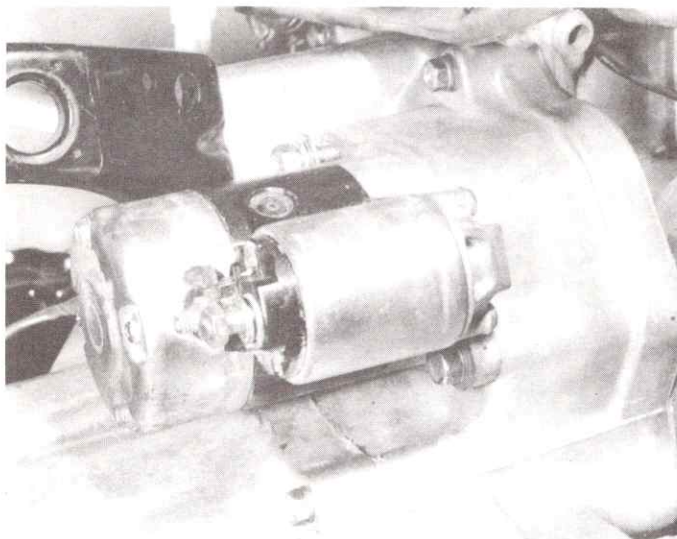
20.27C ... and exhaust manifold and shield



20.28 The alternator mounting bracket



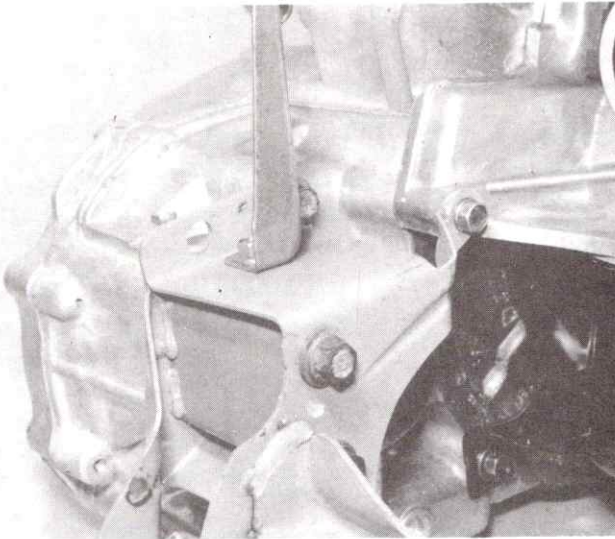
20.32 Transmission unit ready to be bolted to the engine



20.33 Bolt on the starter motor



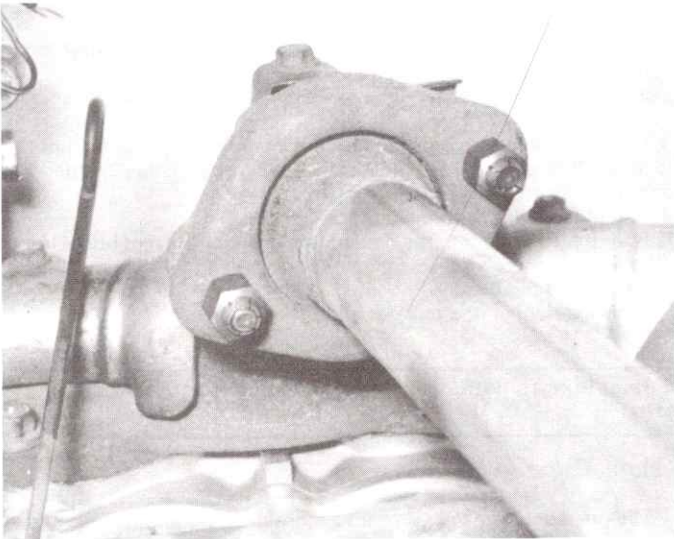
20.34A Fit the engine mountings ...



20.34B ... in their appropriate positions

## 21 Engine/transmission unit – refitting

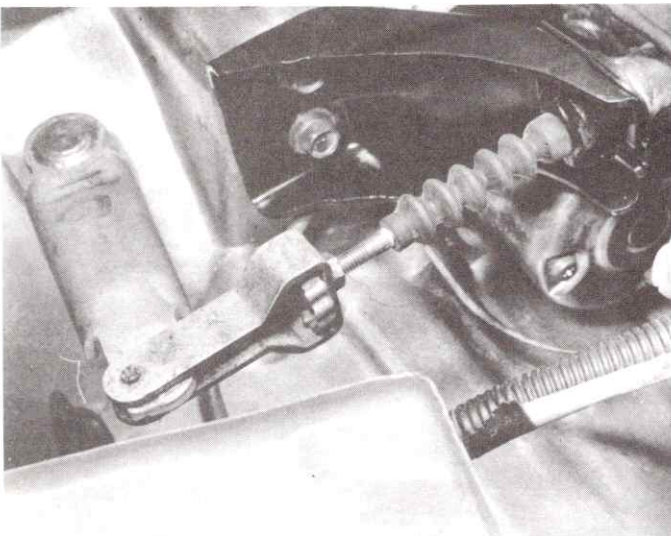
- 1 Connect the hoist to the lifting lugs, raise the engine and lower it slowly into the engine compartment.
- 2 Manoeuvre the engine around gently while fitting the bolts to the engine mountings. Once all the mountings are fitted and bolts tightened, remove the lifting gear.
- 3 From underneath the vehicle, connect the gear change control rod (Chapter 6).
- 4 Refer to Chapter 8 and refit the driveshafts. Do not forget to tighten the top suspension strut bolts if they were undone.
- 5 Refit the brake calipers and roadwheels.
- 6 Bolt up the exhaust downpipe and the exhaust pipe intermediate bracket if this has been undone for access (photos).
- 7 Refit the speedometer drive cable after filling the transmission with oil.
- 8 Reconnect the clutch operating cable to the operating arm, and check the clutch adjustment (Chapter 5) (photo).
- 9 Reconnect the fuel lines to the pump and carburettor (photos).
- 10 Connect the throttle and choke control cable as appropriate. On models with an automatic choke reconnect the electrical lead.
- 11 Reconnect the reversing lamp lead, oil pressure switch lead and water temperature transmitter leads (photo).



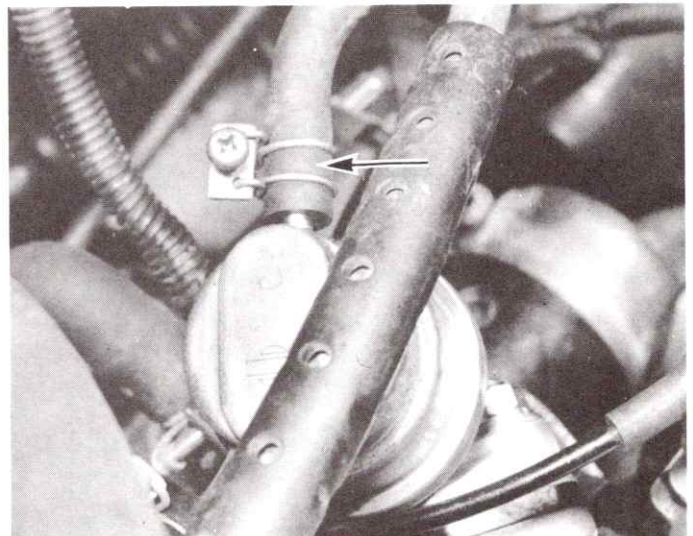
21.6A Connect the exhaust downpipe



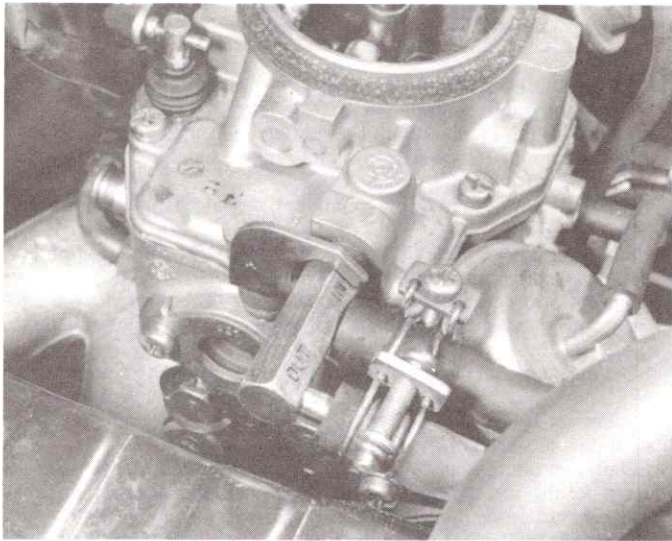
21.6B Intermediate support bracket



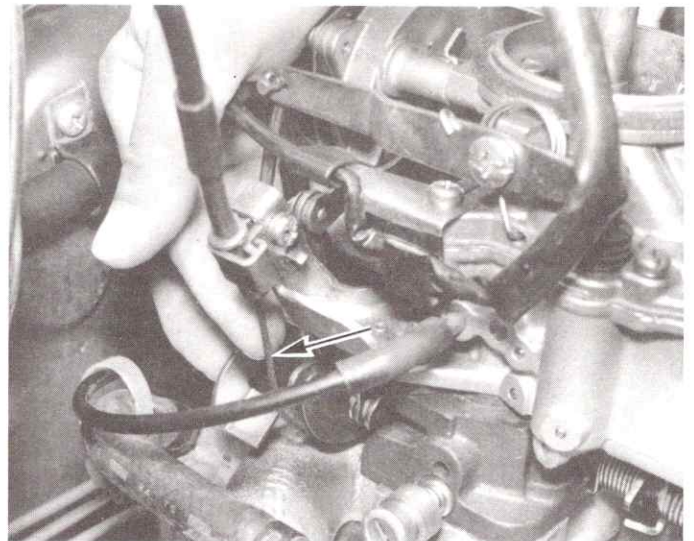
21.8 Clutch control cable end fitting



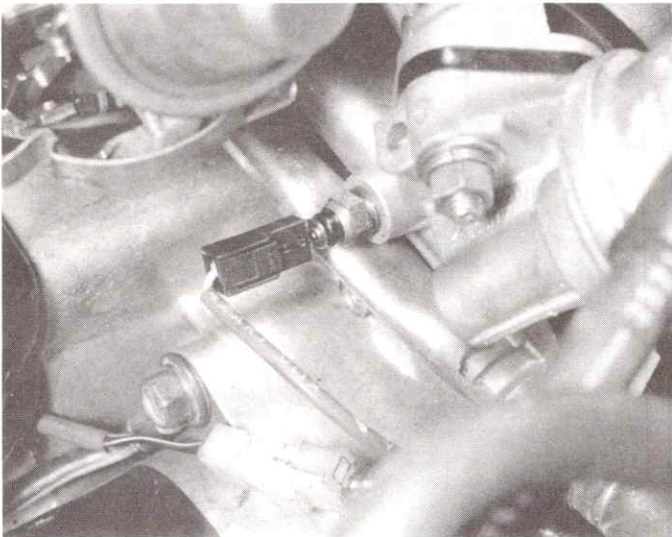
21.9A Fuel pump supply hose (arrowed)



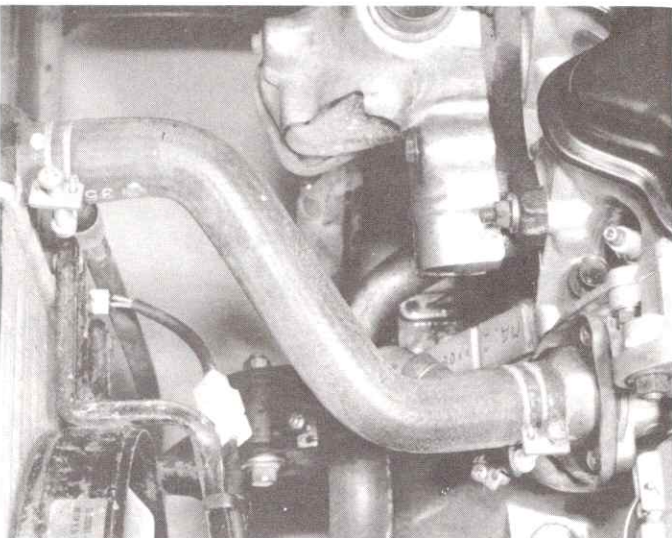
21.9B Connections at the carburettor



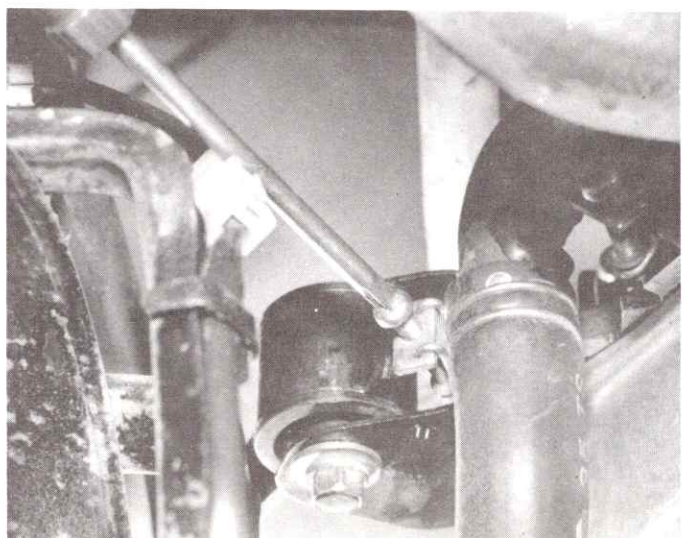
21.10 Throttle control cable



21.11 Water temperature electrical lead



21.13A Top radiator hose



21.13B Bottom radiator hose ...

12 Refer to the relevant Chapters and refit the distributor and alternator if these were not fitted previously. Fit the alternator belt and tension it. Fit the drivebelts to the power steering and air conditioner if fitted.

13 Refit the radiator, connect the coolant hoses and heater hoses, reconnect the electric fan cable and refill the system (Chapter 2) (photos).

14 Refill the engine with oil, refit the dipstick.

15 Refit the air cleaner to the carburettor, ensuring all vent hoses from the rocker cover are connected, and connect also the vacuum hoses.

16 Reconnect the battery.

17 Refit the bonnet and radiator grille.

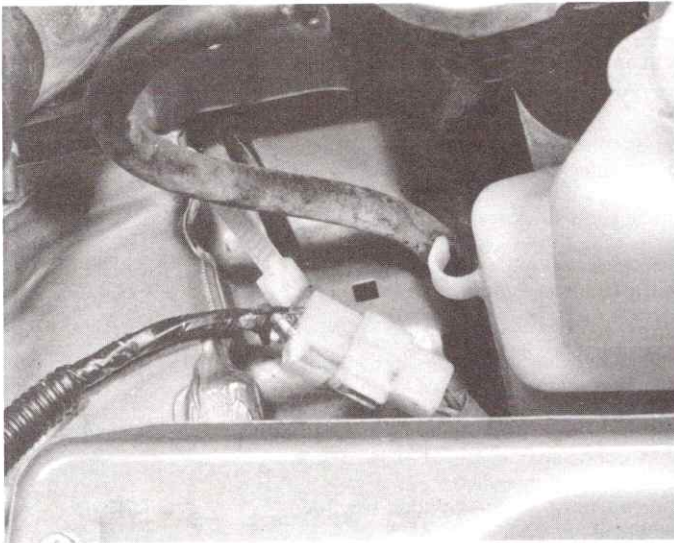
## 22 Engine/automatic transmission – reconnection and refitting

### Reconnection

Refer also to Chapter 7

1 The operations are very similar to those described in the preceding Section, but the following special points should be noted.

2 Before connecting the driveplate to the torque converter, check to see that the converter is pushed fully home by referring to Chapter 7.



21.13C ... and the cooling fan electrical connection

3 Align the marks on the driveplate and torque converter (made before dismantling). Apply thread locking fluid to the clean threads of the connecting bolts and tighten them to the specified torque. Bolt on the starter motor, and reconnect the kick-down cable.

#### Refitting

4 Reconnect the speed selector control cable and adjust it, if necessary.

- 5 Reconnect the inhibitor switch leads.
- 6 Reconnect the oil cooler hoses.
- 7 Refit the front wing protective shield where fitted.
- 8 Top up the automatic transmission fluid.

### 23 Initial start-up after major overhaul

- 1 Set the idle speed screw to a higher setting than normal to offset the drag caused by new engine components.
- 2 Start the engine. This may take rather longer than usual as the fuel pump has to fill the carburettor with fuel.
- 3 Once the engine starts, allow it to warm without racing and then check for oil leaks.
- 4 There will be some odd smells caused by oil and grease burning off metal surfaces.
- 5 Treat the engine as a new unit for the first few hundred miles by restricting speed and load.
- 6 Once the engine is run-in after 1000 km (600 miles), check the idle speed, the valve clearances and the tightening torque of all engine nuts and bolts. Change the engine oil and filter at the same time.

### 24 Crankcase ventilation system (PCV)

- 1 This is of positive, dual-line type which returns blow-by gas (which has passed the piston rings) from the crankcase to either the air cleaner or the intake manifold, according to manifold vacuum.
- 2 Check the system connecting hoses regularly and clean them out.
- 3 To test the operation of the valve, have the engine idling and disconnect the hoses from the side of the valve which is furthest from the intake manifold. Vacuum hiss should be heard coming from the open end of the valve and a strong suction felt if a finger is placed over it. If this is not so, renew the valve.

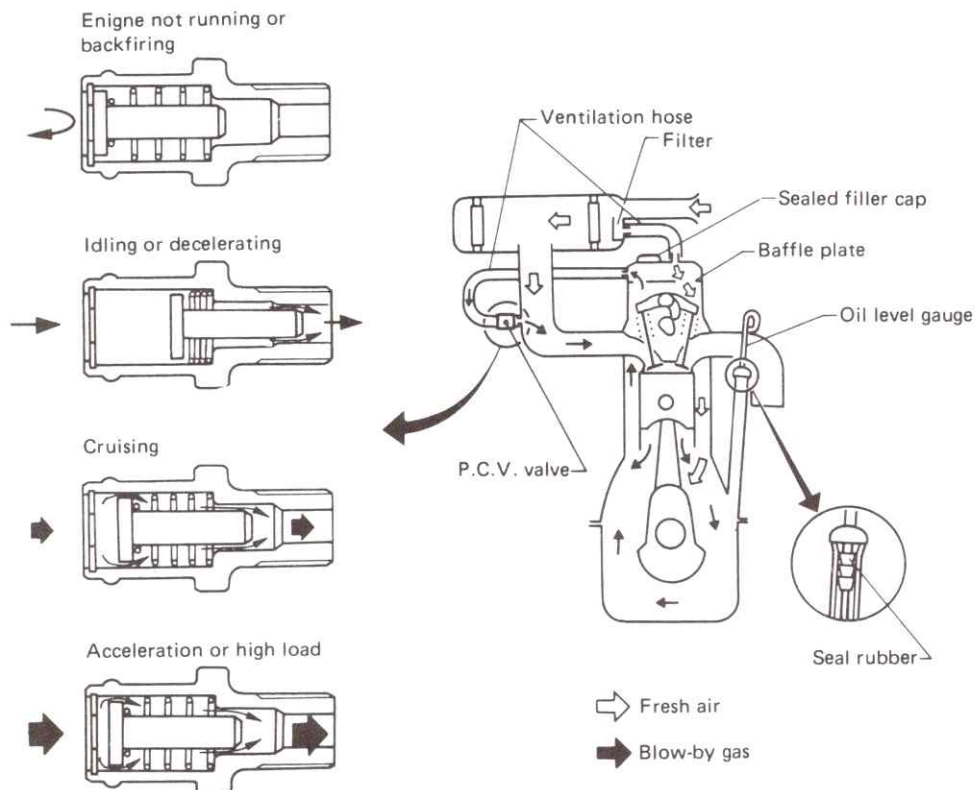


Fig. 1.23 Crankcase ventilation system (Sec 24)

## 25 Fault diagnosis – engine

Symptom	Reason(s)
<b>Engine fails to turn when starter control operated</b> No current at starter motor	Flat or defective battery Loose battery leads Defective starter solenoid or switch or broken wiring Engine earth strap disconnected
Current at starter motor	Jammed starter motor drive pinion Defective starter motor
<b>Engine turns but will not start</b> No spark at spark plug	Ignition leads or distributor cap damp or wet Ignition leads to spark plugs loose Shorted or disconnected low tension leads Dirty, incorrectly set, or pitted contact breaker points Faulty condenser Defective ignition switch Ignition leads connected wrong way round Faulty coil Contact breaker point spring earthed or broken
No fuel at engine	No petrol in petrol tank Vapour lock in fuel line (in hot conditions or at high altitude) Blocked float chamber needle valve Fuel pump filter blocked Choked or blocked carburettor jets (where applicable) Faulty fuel pump
<b>Engine stalls and will not restart</b> Excess of petrol in cylinder or carburettor flooding	Too much choke allowing too rich a mixture or wet plugs Float damaged or leaking or needle not seating Float lever incorrectly adjusted
No spark at spark plug	Ignition failure – sudden Ignition failure – misfiring precedes total stoppage Ignition failure – in severe rain or after traversing water splash
No fuel at jet	No petrol in petrol tank Petrol tank breather choked Sudden obstruction in carburettor Water in fuel system
<b>Engine misfires or idles unevenly</b> Intermittent spark at spark plug	Ignition leads loose Battery leads loose on terminals Battery earth strap loose on body attachment point Engine earth lead loose Low tension leads on coil loose Low tension lead on distributor loose Dirty or incorrectly gapped plugs Dirty, incorrectly set, or pitted contact breaker points Tracking across inside of distributor cover Ignition too retarded Faulty coil Slack timing belt
Fuel shortage at engine	Mixture too weak Air leak in carburettor Air leak at inlet manifold to cylinder head, or inlet manifold to carburettor
<b>Lack of power and poor compression</b> Mechanical wear	Burnt out valves Sticking or leaking valves Worn or broken valve springs Worn valve guides or stems Worn pistons and piston rings

# Chapter 2 Cooling system

For modifications, and information applicable to later models, see Supplement at end of manual

## Contents

Coolant mixture – general .....	4	Radiator – removal, repair and refitting .....	6
Coolant temperature switch .....	10	Radiator cooling fan and temperature transmitter switch –	
Cooling system – draining, flushing and refilling .....	3	removal and refitting .....	7
Drivebelts – removal, fitting and adjustment .....	9	Routine maintenance .....	2
Fault diagnosis – cooling system .....	11	Thermostat – removal, testing and refitting .....	5
General description .....	1	Water pump – removal and refitting .....	8

## Specifications

**System type** ..... Pressurised, circulation pump driven from camshaft drivebelt, radiator, thermostat and electric cooling fan

**Radiator cap relief pressure** ..... 13 lbf/in<sup>2</sup> (0.9 kgf/cm<sup>2</sup>)

### Thermostat

Opening temperature ..... 88°C (190°F)  
Maximum valve lift ..... 8 mm at 100°C (0.31 in at 212°F)

### Coolant temperature switch

Switches on at ..... 90°C (194°F)

### Drivebelt tensions

The deflection is to be measured midway between pulleys on the belt's longest run. The tension of a new belt should be checked after the vehicle's first operating period, when the belts should be set to the 'used belt' values.

Standard or air conditioner equipped models:

	Deflection (used belt)	Deflection (new belt)
Alternator .....	18 to 22 mm (0.71 to 0.87 in)	15 to 19 mm (0.59 to 0.75 in)
Air conditioner compressor .....	7.5 to 11.5 mm (0.295 to 0.453 in)	7 to 9 mm (0.28 to 0.35 in)

Power steering equipped models:

	Deflection (used belt)	Deflection (new belt)
Alternator .....	13.5 to 16 mm (0.531 to 0.630 in)	12.5 to 14 mm (0.492 to 0.551 in)
Power steering oil pump .....	6.5 to 8.5 mm (0.256 to 0.335 in)	6 to 7.5 mm (0.236 to 0.295 in)

Air conditioning and power steering equipped models:

	Deflection (used belt)	Deflection (new belt)
Alternator .....	10 to 12 mm (0.39 to 0.47 in)	9.5 to 10.5 mm (0.374 to 0.413 in)
Air conditioner compressor .....	6.5 to 7.5 mm (0.256 to 0.295 in)	5.5 to 6.5 mm (0.217 to 0.256 in)
Power steering oil pump .....	6.5 to 8.5 mm (0.256 to 0.335 in)	6 to 7.5 mm (0.236 to 0.295 in)

### Coolant

Capacities:

Cooling system (including heater) .....	6.86 pts (3.9 litres)
Expansion tank .....	1.40 pts (0.8 litres)
Coolant type .....	Ethylene glycol based antifreeze (Duckhams Universal Antifreeze and Summer Coolant)

### System capacity

Cooling system (including heater) .....	6.86 pt (3.9 litre)
Expansion tank .....	1.40 pt (0.8 litre)

### Torque wrench settings

	lbf ft	kgf m
Water pump bolts .....	2.9 to 3.6	0.4 to 0.5
Thermostat housing bolts .....	3.6 to 5.8	0.5 to 0.8
Temperature switch in radiator .....	2.2 to 3.6	0.3 to 0.5
Radiator mounting bolts .....	2.3 to 3.2	0.32 to 0.44
Radiator fan shroud nuts .....	2.3 to 3.2	0.32 to 0.44

## 1 General description

The cooling system consists of a front mounted radiator, a pump driven by the camshaft belt, and an electric fan mounted behind the radiator. An expansion tank, mounted on the side of the radiator, eliminates the need for frequent topping up of the system.

Coolant is circulated around the cylinder block water jacket, where it extracts heat from the cylinders and is passed back to the inlet side of the pump. When the coolant is heated to the operating temperature of the thermostat, this will open and allow coolant to flow through the radiator, where it now loses heat to atmosphere, thus being cooled. Should the temperature of the coolant rise sufficiently, the temperature switch in the radiator will operate the electric fan thus providing even more cooling action by drawing more air through the radiator. This is especially effective in slow moving traffic or when the vehicle is stationary, when little or no air is being drawn through the radiator by the vehicle's forward motion.

## 2 Routine maintenance

1 Every 12 000 miles (20 000 km) or 12 months, whichever comes first, check all drivebelts for cracks, fraying, wear and tension, renewing them as necessary. Check all hoses and connections for leaks.

2 Every 24 000 miles (40 000 km) or 24 months, whichever comes first, drain the cooling system and refill with fresh antifreeze solution (photo).

## 3 Cooling system – draining, flushing and refilling

**Warning:** To avoid danger of scalding do not attempt to drain the system when the engine is hot.

1 Set the heater control lever inside the vehicle to the HOT position.

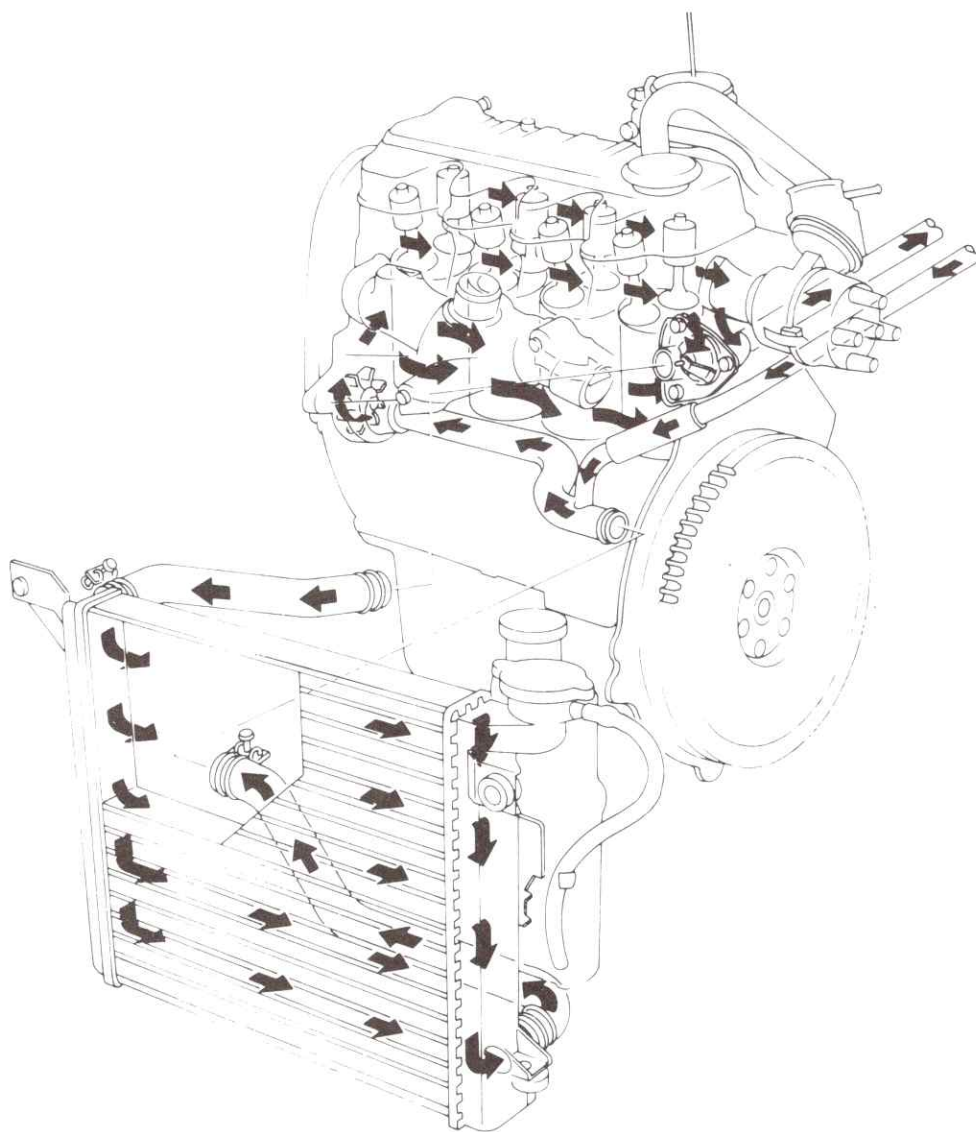
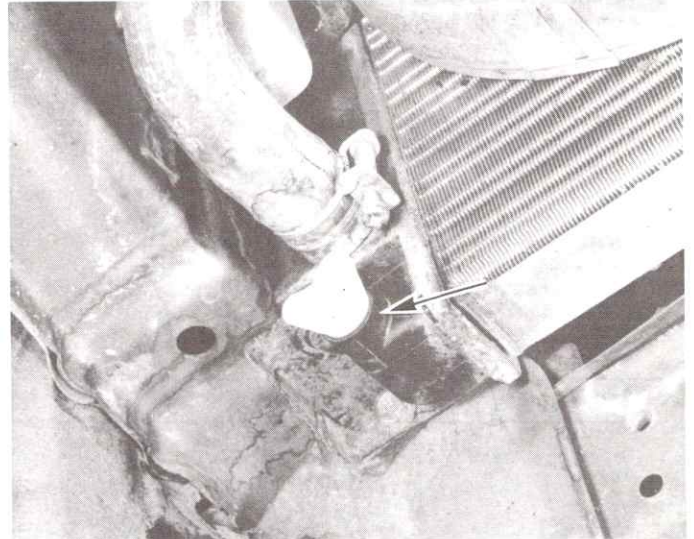


Fig. 2.1 Cooling system flow diagram (Sec 1)



2.2 Topping-up with antifreeze



3.2 Radiator drain plug

2 Open the drain cock at the bottom of the radiator (photo) and remove the radiator filler cap. Allow the coolant to drain.

3 If the coolant being drained is in a clean condition, then the drain cock can be replaced and the system refilled with fresh antifreeze solution.

4 If however, the coolant is badly contaminated with sludge and rust, the system should be flushed through with clean water by inserting a hosepipe in the radiator filler cap. In severe cases it may be necessary or desirable to use a descaling agent to clean the system. In this case follow the manufacturer's instructions.

5 An alternative method of flushing the system is to refill with clean water, refit the radiator cap and run the engine for five or ten minutes before draining, repeating this process until the system is clean.

6 Refill the radiator with coolant to the specified level. On vehicles without a reservoir tank this should be 0.79 to 1.57 in (20 to 40 mm) below the bottom edge of the filler neck, and for those with a reservoir tank, to the MAX mark on the side of the tank.

7 Run the engine for a few minutes and check for leaks, then stop the engine and recheck coolant level, topping up as necessary.

#### 4 Coolant mixture – general

1 It is desirable to keep the cooling system filled with an antifreeze mixture all year round. Apart from the obvious frost protection in winter, antifreeze liquids also contain corrosion inhibitors and should be left in the system all year round.

2 Antifreeze should be mixed according to the manufacturer's instructions, and mixed with clean water in proportion to the frost protection desired. Generally a 50/50 mixture will give maximum protection. Make sure the antifreeze chosen is suitable for aluminium engines.

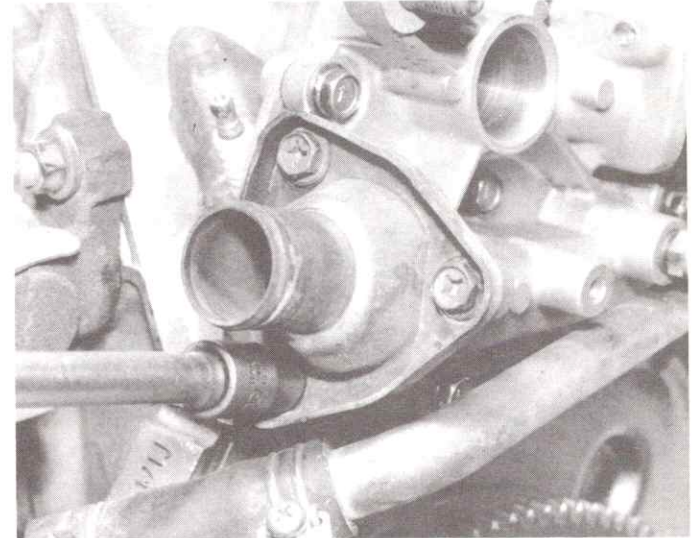
4 The coolant mixture should be renewed every two years as the inhibitors used deteriorate with time, and will be of little value after this time. Also, buy a top quality antifreeze with an ethylene glycol base, as cheaper products usually contain chemicals which evaporate and quickly lose their protection value.

5 When topping up during service, use the same mixture proportion as before, to avoid dilution.

6 If the vehicle is being used in tropical climates, then do remember to use a corrosion inhibitor.

#### 5 Thermostat – removal, testing and refitting

1 The coolant should be drained sufficiently to bring its level below



5.2 Removing the thermostat housing

the thermostat housing, which is situated at the top left-hand side of the engine, by the distributor.

2 Disconnect the hose from the thermostat housing, and then remove the three bolts securing the housing cover and remove the cover (photo).

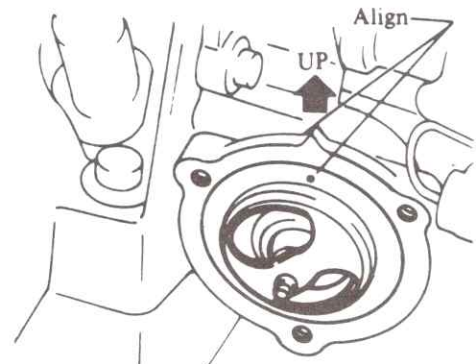


Fig. 2.2 Correct alignment of the thermostat (Sec 5)

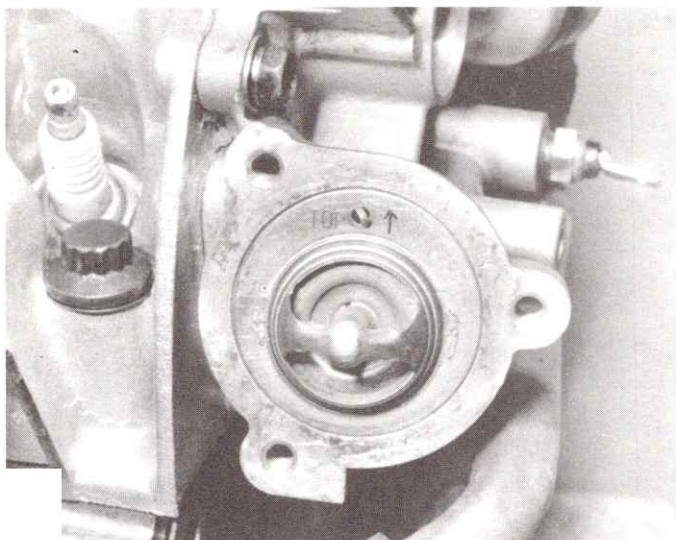
- 3 Remove the thermostat. If it is stuck, do not try to lever it out with a screwdriver or similar, but cut around its rim using a sharp knife, being careful not to damage the soft aluminium housing (photo).
- 4 Check the operation of the thermostat by suspending it in water and bringing the water to the boil, observing that the thermostat opens fully, and that it closes when allowed to cool.
- 5 If the thermostat is defective a replacement should be fitted. It is not wise to run an engine without a thermostat.
- 6 Clean the thermostat housing and fit the thermostat with its bleed hole or jiggle pin at the top. Use a new gasket and refit the cover, tightening the bolts to the specified torque. Do not overtighten (photo).
- 7 Refit the hose, tightening the clip, then refill the system and finally run the engine and check for leaks.

## 6 Radiator – removal, repair and refitting

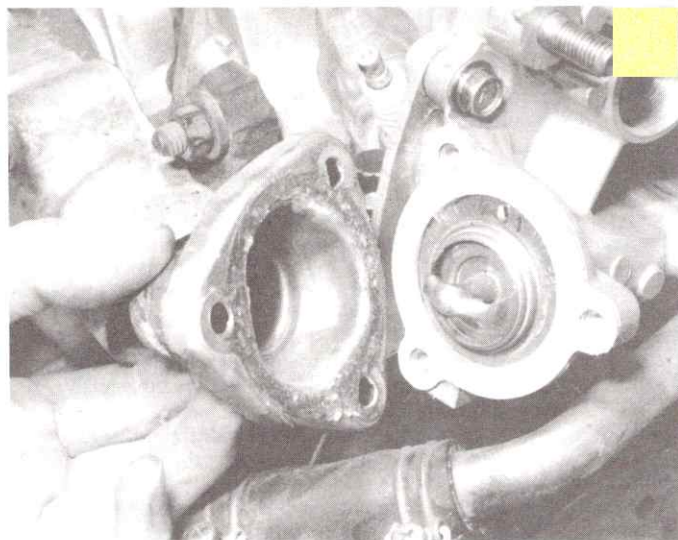
- 1 Drain the system as described in Section 3.

**Note:** If the coolant is in good condition and is not due for periodical change, it may be drained into clean containers and reused.

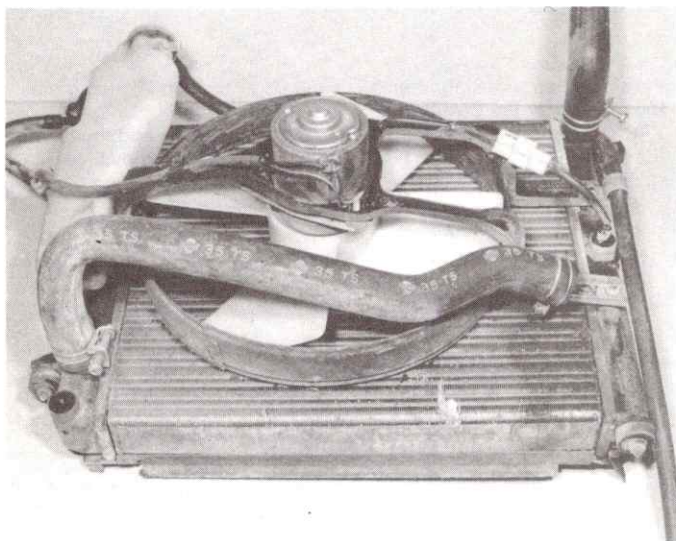
- 2 Where fitted, unbolt the power steering pump and support it on one side, without disconnecting the fluid supply and return lines.
  - 3 Disconnect the top and bottom radiator hoses.
  - 4 Disconnect the electrical leads to the cooling fan and the temperature transmitter.
  - 5 Remove the radiator securing bolts (this varies depending on the type of radiator fitted, but is generally three or four bolts), and lift it out from the engine compartment (photos).
  - 6 The cooling fan and shroud may now be removed, and the radiator leak and pressure tested.
  - 7 It is best to take the radiator to a specialist repairer or your Nissan dealer, who has the necessary equipment for testing and repairing radiators, or to exchange it for a new replacement.
- Note:** the use of chemical sealing components which are added to the coolant to prevent or cure leaks should be regarded as a temporary measure, before proper repairs are carried out.
- 8 Refitting is a reversal of removing, refilling the system as described in Section 3.



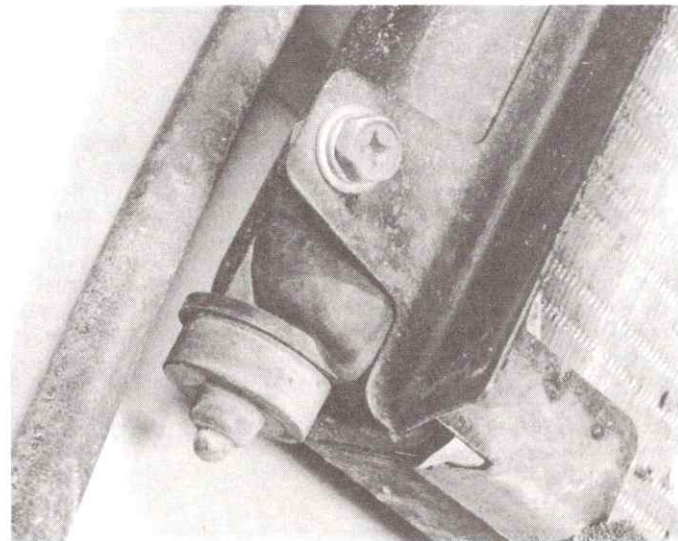
5.3 Remove the thermostat (note the arrow indicating fitment)



5.6 Use a new gasket on refitting



6.5A The radiator and cooling fan assembly removed



6.5B Radiator bottom mounting rubbers

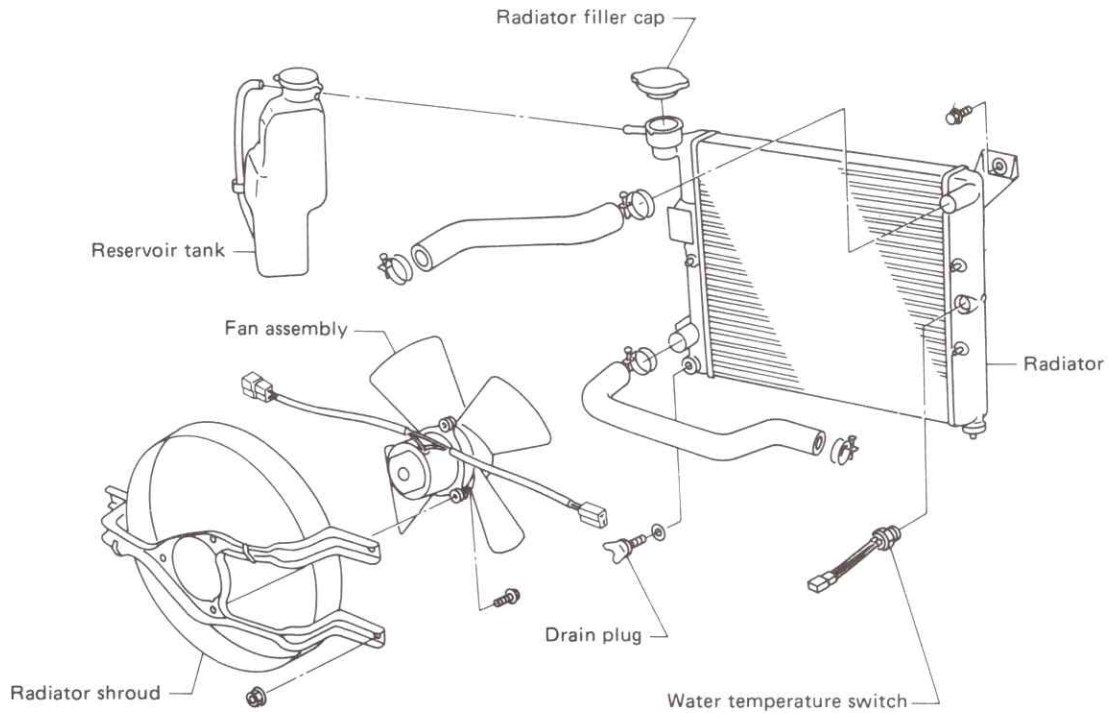


Fig. 2.3 Components of the radiator (Sec 6)

## 7 Radiator cooling fan and temperature transmitter switch – removal and refitting

### Fan

- 1 Disconnect the battery negative lead.
- 2 Disconnect the electrical supply leads at the connector.
- 3 Remove the bolts securing the fan and shroud to the radiator and lift it clear.
- 4 The three bolts which secure the fan to the shroud can now be removed and the two separated.
- 5 On some models, it may be necessary to remove the fan blade assembly from the fan before they can be dismantled. This is held on by a nut.
- 6 Refitting is a reversal of removal.

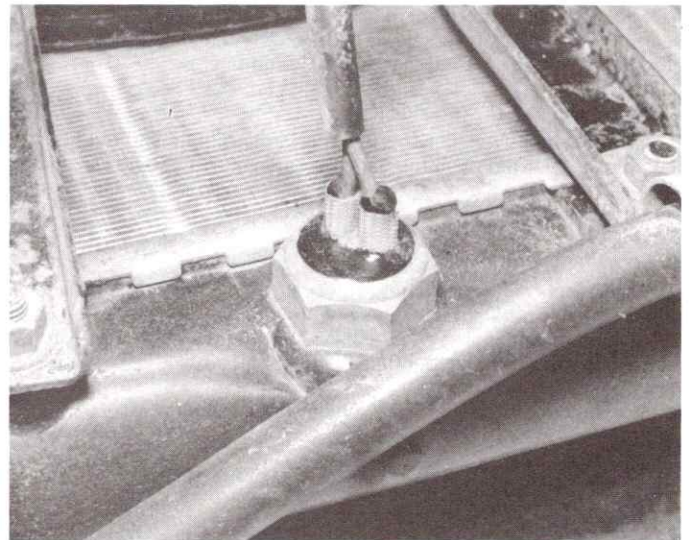
### Switch

- 7 Disconnect the battery negative lead.
- 8 Drain the cooling system as described in Section 3.
- 9 Disconnect the electrical supply lead to the switch at the multi-block connector.
- 10 Unscrew the switch, remove and discard the sealing washer (photo).
- 11 The switch can be tested by connecting a battery and bulb in line between the two terminals, lowering the switch into water and raising the temperature of the water to the specified switching on temperature.
- 12 Refitting is a reversal of removal, but use a new sealing washer under the switch and refill the system as described in Section 3.

## 8 Water pump – removal and refitting

### Removal

- 1 The water pump is driven by the camshaft/timing drivebelt, and reference should be made to Chapter 1 for removal of the alternator drivebelt, right-hand engine mounting bracket and the timing belt covers. Before removing the engine mounting, the engine should be



7.10 Radiator cooling fan switch

supported from underneath the oil pan. If fitted, then the power steering and air conditioning unit drivebelts will also have to be removed. It is also important that the engine is set at TDC, No 1 cylinder on its compression stroke, so as not to lose engine timing. Refer to Chapter 1 for details.

**Caution:** with the timing belt removed do not turn the crankshaft or camshaft sprockets, or the valves may hit the pistons causing damage.

- 2 Once the timing belt covers are removed and access to the drivebelt gained, slacken the bolt at the centre of the tensioner unit and remove the timing belt.

3 Remove the five bolts which secure the water pump to the cylinder block, and remove it. The water pump is a sealed unit and cannot be repaired. If it is defective, replace it with a new unit (photo).

### Refitting

4 Clean both mating surfaces thoroughly, ensuring all traces of old gasket are removed.

5 Smear a little grease or petroleum jelly on the mating surface of the water pump, then position a new paper gasket in place on it.

6 Fit the pump in place on the cylinder block and fit and tighten the five securing bolts to the specified torque (photo). These bolts must be fitted using sealing compound on their threads or water leaks will be apparent after assembly.

7 Refit the timing belt covers, crankshaft pulley, alternator and drivebelt, and the power steering and air conditioning drive belts as necessary.

8 Tension the drivebelts as described in Section 9.

9 Fill the cooling system on completion, run the engine and check for leaks.



8.3 Water pump assembly removed

## 9 Drivebelts – removal, fitting and adjustment

1 An alternator is fitted to all models, driven by belt from the crankshaft pulley. Some models may also have power steering and air conditioning units fitted, and these too are driven by belt from the crankshaft pulley.

2 Belts should be checked for cracking, fraying, general wear and oil contamination and renewed as necessary. Drivebelts should not touch the bottom of the groove of the pulley in which they run.

### Alternator drivebelt

3 Slacken the alternator mounting and adjuster link bolts and push the alternator in sufficiently to allow the belt to be slipped off its pulleys.

4 Fit a new belt and tension it to the values given in the Specification (photo). The figures given measure the required deflection of the belt, along its longest run, under moderate thumb pressure.

### Power steering drivebelt

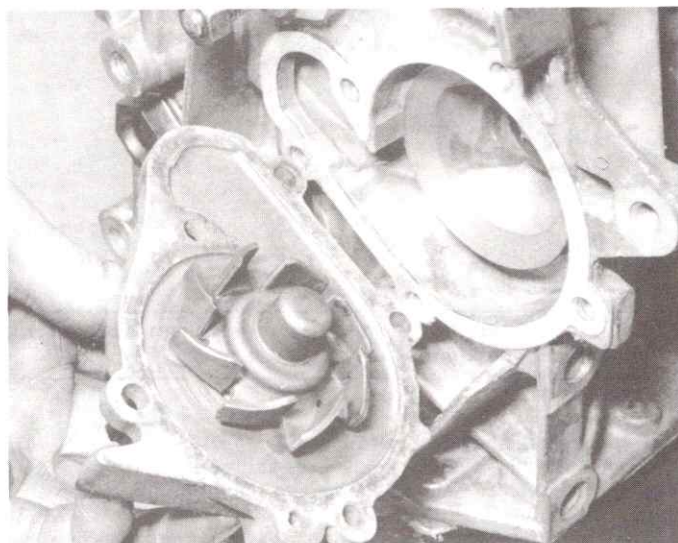
5 Slacken the power steering pump mounting bolts and the bolt on the adjuster link and push the pump in sufficiently to allow the belt to be slipped off its pulleys. Fit a new belt and tension it, as described in paragraph 4.

### Air conditioning belt

6 Where an air conditioning unit is fitted, then the drivebelt arrangement is different from those without it.

7 The arrangement is as shown in Fig. 2.4 and the belt is removed by slackening off the idler pulley adjusting bolt until the belt can be removed.

8 The belt is tensioned by tightening the idler pulley adjusting bolt, as described in paragraph 4.



8.6 Use a new gasket when refitting the pump

## 10 Coolant temperature switch

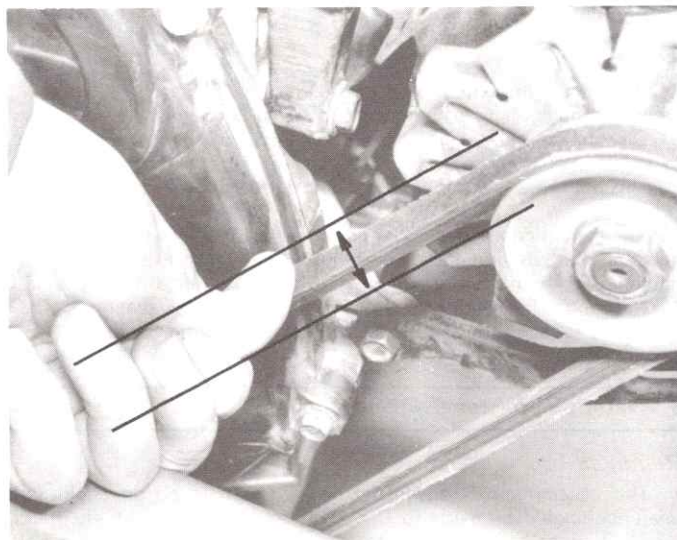
1 Drain the system sufficiently to allow the temperature transmitter switch to be removed without loss of coolant.

2 Testing requires special electrical meters, and should be left to your dealer or auto-electrician.

3 Before removing a switch which is suspected of malfunction, check the switch-to-gauge lead is not being earthed by faulty insulation.

4 A maximum temperature reading on the gauge as soon as the ignition is switched on indicates a fault in either the switch or the gauge.

5 To remove the switch which is situated in the cylinder head, by the thermostat housing (photo), disconnect its electrical lead and unscrew it from its housing. On refitting, use a new sealing washer.



9.4 Checking alternator drivebelt tension

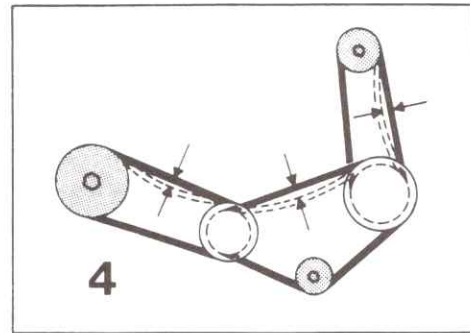
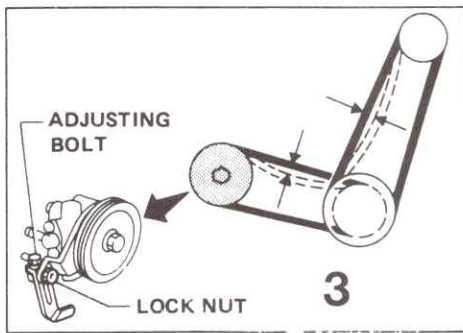
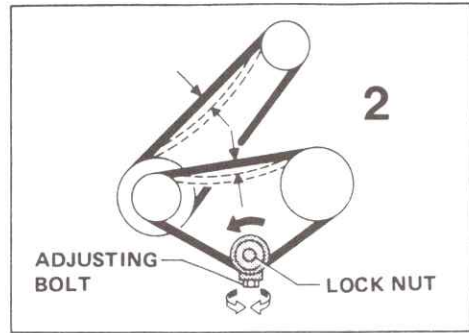
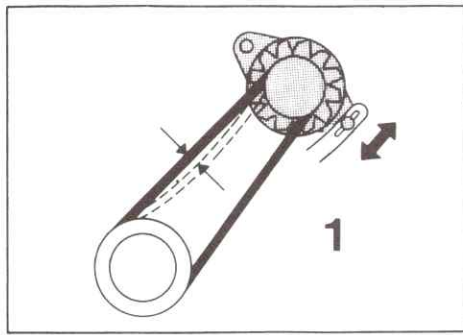


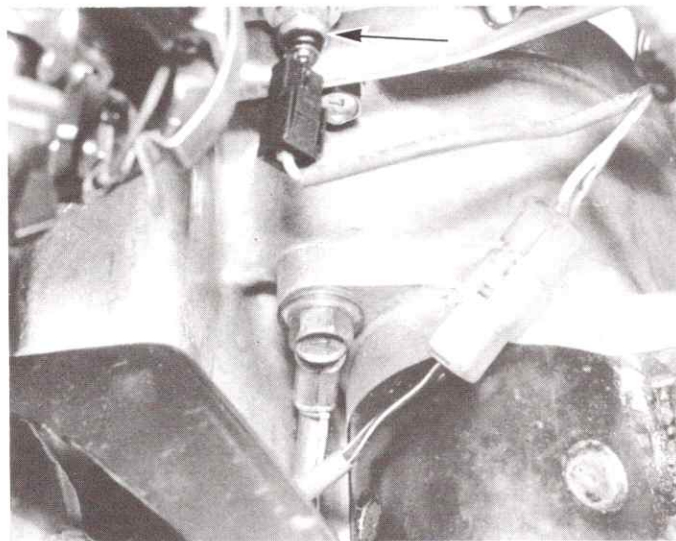
Fig. 2.4 Drivebelt tensioning and adjustment (Sec 9)

1 Alternator belt

2 With air conditioner

3 With power steering

4 With air conditioner and power steering



10.5 Water temperature transmitter switch

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**11 Fault diagnosis – cooling system**

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Symptom	Reason(s)
Overheating	Loss of coolant Faulty fan or switch Faulty thermostat Radiator matrix clogged
Underheating	Faulty thermostat Faulty fan or switch
Loss of coolant	External leakage Internal leakage (cylinder head gasket blown) Overheating (causing evaporation)
Poor performance from heater	Air lock in heater matrix or pipes (loosen outlet hose clip from heater, with engine running, and allow trapped air to escape)

# Chapter 3

## Fuel, exhaust and emission control systems

*For modifications, and information applicable to later models, see Supplement at end of manual*

### Contents

Accelerator pedal and cable – removal, refitting and adjustment .....	16	Emission control system – general .....	15
Air filter element – removal and refitting .....	3	Exhaust system – removal and refitting .....	19
Air filter housing – removal and refitting .....	4	Fault diagnosis – fuel, exhaust and emission control system .....	20
Carburettor – adjustments .....	11	Fuel filter (in-line) – description, removal and refitting .....	8
Carburettor – general description .....	9	Fuel pump – removal, inspection and refitting .....	7
Carburettor – idle speed and mixture adjustment .....	10	Fuel tank – removal, repair and refitting .....	18
Carburettor – overhaul .....	13	General description .....	1
Carburettor – refitting .....	14	Idle compensator device – description and inspection .....	6
Carburettor – removal .....	12	Routine maintenance .....	2
Choke control cable – removal and refitting .....	17	Winter/summer changeover valve – general .....	5

### Specifications

#### General

System type .....	Mechanical fuel pump, twin barrel downdraught carburettor, with manual or automatic choke
Fuel tank capacity .....	8.8 gal (40 litre)
Octane rating (RON):	
Four-speed transmission models .....	88 minimum (2-star)
Five-speed and automatic transmission models .....	96 minimum (4-star)
Fuel pump pressure .....	2.8 to 3.8 lbf/in <sup>2</sup> (0.20 to 0.27 kgf/cm <sup>2</sup> )

#### Carburettor

Type:		
Manual transmission .....	Hitachi DCZ 306-81	
Automatic transmission .....	Hitachi DCZ 306-82	
Idling speed:		
Manual transmission .....	750 to 850 rev/min	
Automatic transmission .....	850 to 950 rev/min	
Fast idling speed:		
Manual transmission .....	1700 to 2100 rev/min	
Automatic transmission .....	1800 to 2200 rev/min	
CO content at idle .....	1.5 ± 0.5%	
Jet sizes:	<b>Primary</b>	<b>Secondary</b>
Main jet .....	94	130
Main air bleed .....	80	80
Slow jet .....	43	75
Slow air bleed .....	160	80
Power jet .....	45	--
Fuel inlet needle valve .....	20	--

**Carburettor settings**

Vacuum break clearance R .....	1.22 ± 0.15 mm (0.0480 ± 0.0059 in)
Choke unloader clearance C .....	2.01 mm (0.079 in)
Primary and secondary valve plate interlock clearance G .....	5.49 ± 0.3 mm (0.216 ± 0.012 in)
Dashpot/stop lever contact engine speed .....	1800 to 2200 rev/min
Primary throttle valve-to-inner wall clearance A (automatic choke)	
Manual transmission .....	0.44 ± 0.07 mm (0.0173 ± 0.0028 in)
Automatic transmission .....	0.62 ± 0.07 mm (0.0244 ± 0.0028 in)
Primary throttle valve-to-inner wall clearance A (manual choke) .....	1.33 ± 0.07 mm (0.0524 ± 0.0028 in)
Float level adjustment dimension H:	
Top float position .....	14 mm (0.55 in)
Bottom float position .....	46 mm (1.81 in)
Throttle cable adjustment a .....	1.0 to 3.0 mm (0.04 to 0.12 in)
Choke cable adjustment s .....	21 to 25 mm (0.83 to 0.98 in)

**Note:** See text for explanation of dimensional letters

**Torque wrench settings**

	lbf ft	kgf m
Anti-dieseling valve .....	13 to 16	1.8 to 2.2
Idle speed control valve .....	13 to 16	1.8 to 2.2
Fuel tank mounting bolts .....	19.7 to 26.6	2.72 to 3.68
Fuel tank drain plug .....	12 to 15	1.6 to 2.1
Exhaust downpipe to manifold .....	22 to 26	3.0 to 3.6
Exhaust mounting bolts .....	5.8 to 8.7	0.8 to 1.2
Intermediate exhaust clip .....	12 to 15	1.6 to 2.1

**1 General description**

The fuel system consists of a rear mounted tank, the fuel pump being mechanical and mounted on the engine, where it draws fuel via a filter mounted on the engine bulkhead, pumping it to the carburettor.

The carburettor, a Hitachi DCZ 306, is of twin barrel, downdraught type, with either manual or automatic choke, depending on model.

All models have emission control systems.

**2 Routine maintenance**

1 Every 6000 miles (10 000 km) or 6 months whichever comes first check and adjust the engine idle speed. Also check the condition and security of the fuel lines and exhaust system.

2 Renew the air cleaner every 24 000 miles (40 000 km) or 24 months whichever comes first. Also renew the fuel filter.

**3 Air filter element – removal and refitting**

1 The air filter paper element should be renewed at the intervals indicated in the Routine Maintenance schedule. The element requires no special cleaning in between these intervals.

2 To renew the element, undo the central retaining nut (photo), remove the cover and lift out the element.

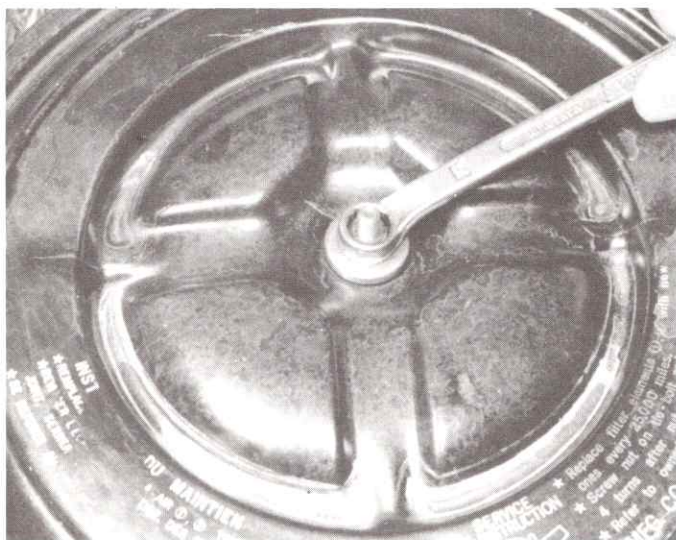
3 Refitting is a reversal of this procedure.

**4 Air filter housing – removal and refitting**

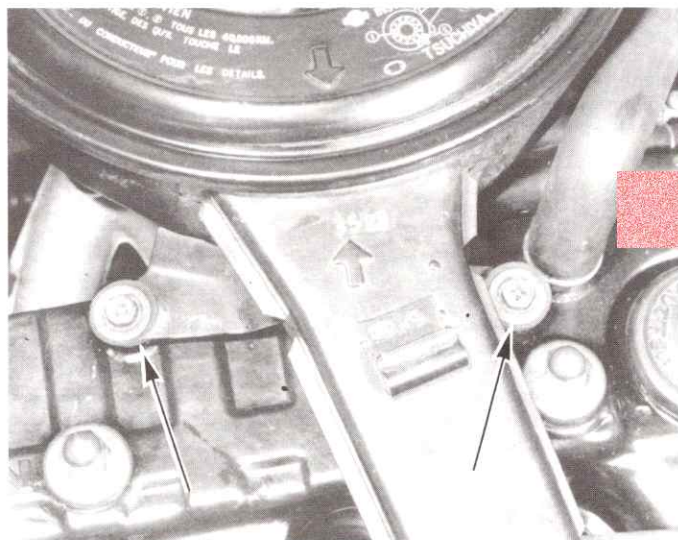
1 Remove the element as described in Section 3, then undo the two bolts attaching the air filter housing to the rocker cover (photo).

2 Remove the air hose connecting the filter housing to the hot air collector plate on the exhaust manifold (photo).

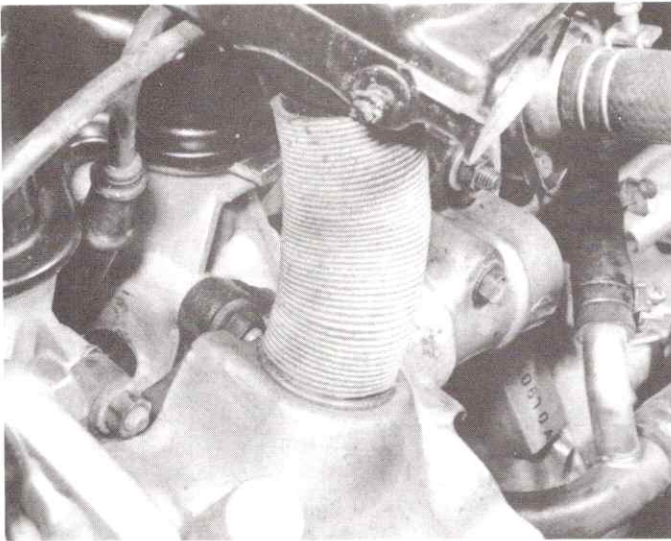
3 Disconnect the air tube to the idle compensator device.



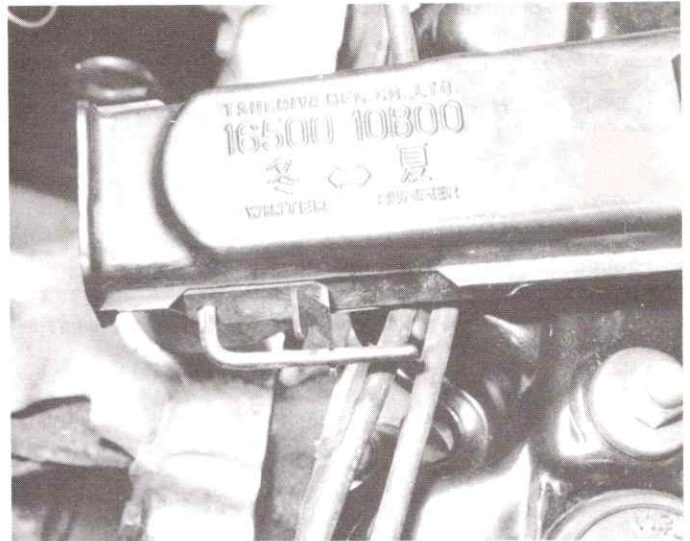
3.2 Air filter central retaining nut



4.1 Two bolts secure the housing to the rocker cover (arrowed)



4.2 Air hose from exhaust manifold to air filter housing



5.1 Winter/summer changeover valve

- 4 Disconnect all breather hoses as necessary to clear the filter housing, and remove it from the carburettor.
- 5 Refitting is a reversal of removal.

#### 5 Winter/Summer changeover valve – general

- 1 This changeover valve is situated in the air filter housing air intake (photo).
- 2 It is a simple flap valve, drawing air either directly from atmosphere (summer), or warmed air from around the exhaust manifold (winter).
- 3 It is operated manually by a lever on the side of the intake.

#### 6 Idle compensator device – description and inspection

- 1 The idle compensator device is situated in the air filter housing (photo).
- 2 It is a simple contact switch of bi-metallic material, and its purpose is to allow an air bleed to the carburettor to stabilise engine idle speed under high temperature conditions.
- 3 Under cold conditions of idle the valve will be closed. Under hot conditions, the bi-metal strip will open the air bleed hole to allow air to be drawn in to the inlet manifold, where it is mixed with the normal fuel/air mixture. This weakens the fuel/air ratio, and prevents rich mixtures under these conditions.

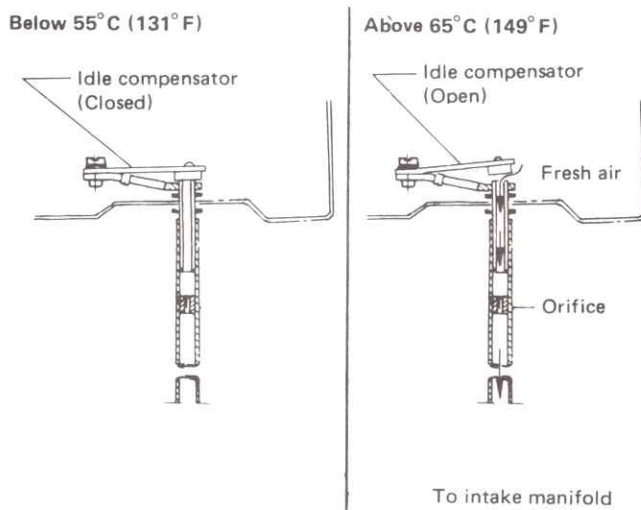


Fig. 3.1 Diagrammatic views of idle compensator valve operation (Sec 6)



6.1 The bi-metal idle compensator in air filter housing

4 The idle compensator is in good condition if a hissing noise can be heard coming from it with the engine running and the temperature above that at which the idle compensator should operate (see Fig. 3.1).

5 It can be tested for correct operation by using a hair dryer to blow hot air on it and checking to see if it operates.

## 7 Fuel pump – removal and refitting

**Caution:** Before working on any part of the fuel system involving fuel lines, disconnect the battery.

1 The fuel pump is situated to the rear of the cylinder block, by the distributor and water thermostat.

2 To remove the pump disconnect the fuel lines and plug the line from the fuel tank.

3 Undo the two nuts securing it to the housing (photo).

4 Clean the pump and then test it as follows.

5 Drain all fuel from the pump, then block off the inlet port with your finger. You should not now be able to operate the cam lever.

6 Remove your finger from the inlet port and listen for a suction sound. This will indicate that sufficient suction was produced.

7 Next, block off the outlet port with your finger and operate the cam lever. After air pressure had been built up, check that pressure remains for two or three seconds.

8 If the pump appears not to be working, change the complete unit, as it cannot be dismantled for repair.

9 Remove the lever operating rod from the fuel pump housing and check it for wear. Lubricate the rod and refit it (photo).

10 Use a new gasket (photo) before bolting the pump back into position and connecting up the fuel lines.

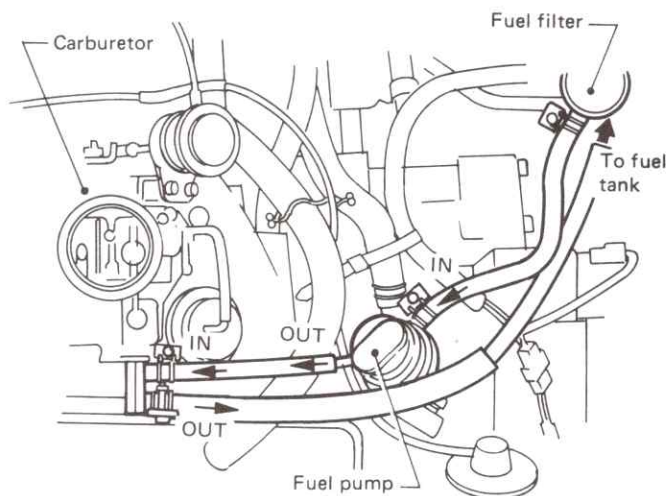


Fig. 3.2 Fuel flow diagram (Sec 7)

## 8 Fuel filter (in-line) – description, removal and refitting

1 An in-line fuel filter is used between the tank and the pump.

2 It is mounted on the engine bulkhead (photo).

3 The filter is a sealed unit and if it becomes blocked, or leaks, it should be renewed.

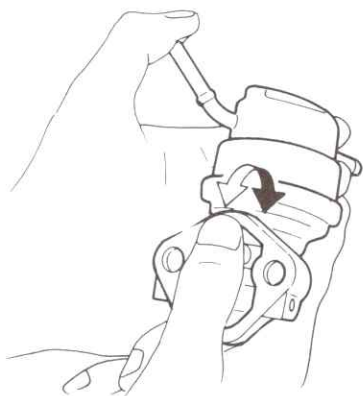
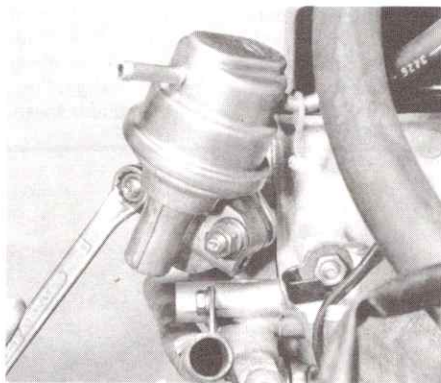
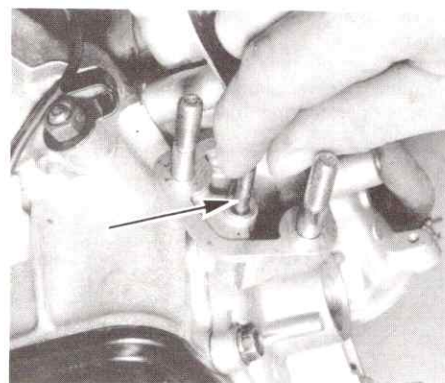


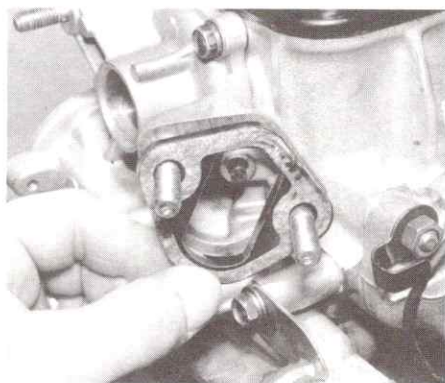
Fig. 3.3 Checking the fuel pump operation (Sec 7)



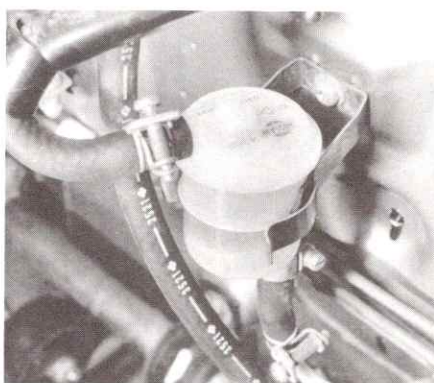
7.3 Fuel pump securing nuts



7.9 Fuel pump lever operating rod



7.10 Fit a new gasket on refitting



8.2 In-line fuel filter on engine bulkhead

- 4 Undo the fuel line clips, pull the filter from the bulkhead clip, and pull off the fuel hoses.
- 5 Refit a new unit in the reverse order.

### 9 Carburettor – general description

- 1 The carburettor is a Hitachi DCZ 306-81 for manual transmission and a DCZ 306-82 for automatic transmission versions.

- 2 It is a twin barrel, downdraught type, fitted with either manual or automatic choke, anti-dieseling device, a temperature sensitive idle compensation system (see Section 6). A secondary throttle vacuum diaphragm is also fitted, which links the primary and secondary throttles. A choke unloader weakens the fuel/air mixture during warm up and a vacuum break diaphragm acts on the choke plate, again to give increased control under starting conditions.
- 3 The DCZ 306-82 for automatic versions has a dashpot device to prevent the engine stalling under certain conditions.

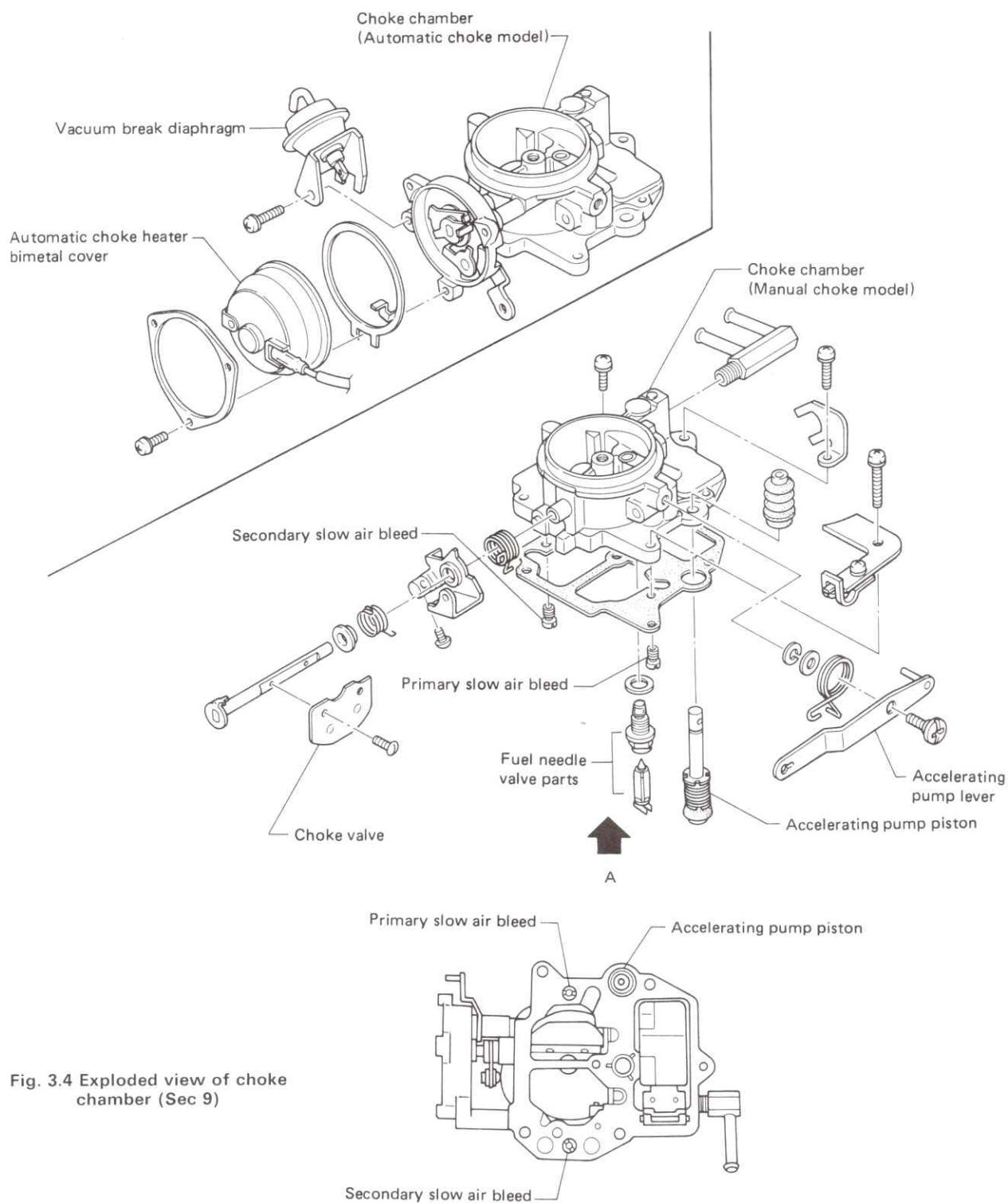


Fig. 3.4 Exploded view of choke chamber (Sec 9)

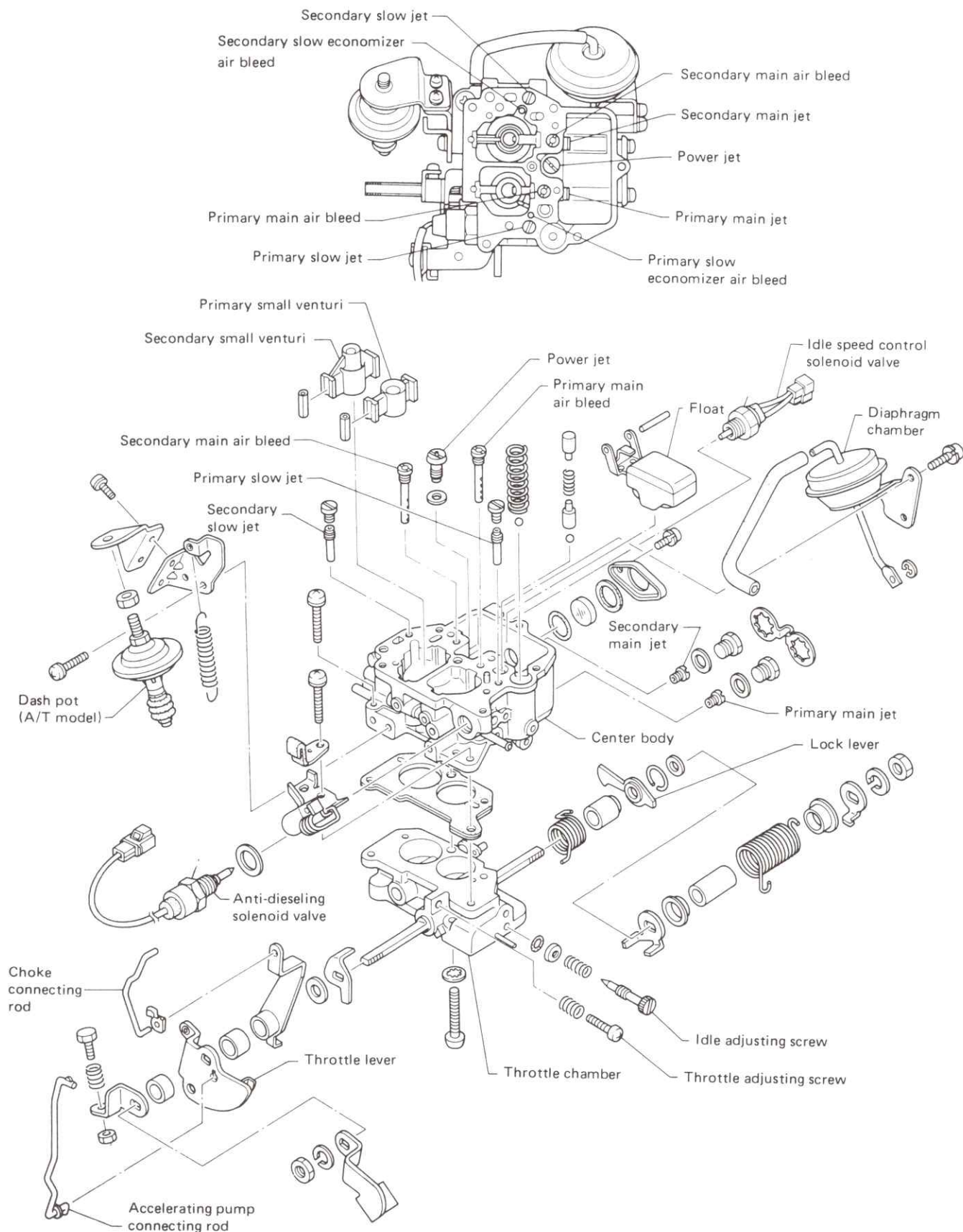


Fig. 3.5 Exploded view of carburettor (Sec 9)

4 These items will be dealt with individually in the following Sections.

5 The fuel system also has a total system inspection facility, which requires specialist equipment.

### 10 Carburettor – idle speed and mixture adjustment

1 The mixture is preset during production and should not normally require altering. However, adjustment may be necessary if the carburettor has been overhauled or after a high mileage when the engine characteristics may have changed slightly due to the build-up of carbon or wear in the engine components.

2 On some models, the idle mixture screw is fitted with a limiter cap (photo). The screw can be turned if a screwdriver blade is ground to a shape similar to that shown in Fig. 3.6.

3 Have the engine at normal operating temperature with the ignition timing and valve clearances correctly set.

4 Connect a tachometer to the engine in accordance with the manufacturer's instructions.

5 If an air conditioner is fitted, make sure that it is switched off.

6 With the engine idling, turn the throttle speed screw (photo 10.2) as necessary to bring the speed within the range given in Specifications.

7 For accuracy, the idle mixture should be adjusted using a CO meter (exhaust gas analyser). Rev up the engine two or three times to clear it and then let it idle. Turn the idle mixture screw until the meter indicates a CO content within the specified tolerance. This adjustment should be carried out quickly. If it extends over more than two minutes, rev the engine again before resuming adjustment.

8 If an exhaust gas analyser is not available, carry out the following alternative method of adjusting the idle mixture. Turn the idle mixture

screw until the engine speed is at its highest level and does not increase any further. Make sure that the engine is idling smoothly and then readjust the throttle speed screw to bring the idle speed within the specified range.

9 If the territory in which the vehicle is being used is subject to strict emission regulations the idle mixture CO content should **always** be checked with an exhaust gas analyser.

10 If the idle mixture screw has been removed during carburettor overhaul, a starting point for mixture adjustment can be established if the screw is turned in very gently until it just seats and then unscrewed two full turns.

11 Note that on power steering models the front wheels should be in the straight ahead position to ensure the pump does not affect the idle speed.

### 11 Carburettor – adjustments

#### Fast idle (automatic choke)

1 Before starting the engine, fully open the throttle valve and check that the choke valve fully closes.

2 Check the index marks on the bi-metal cover of the choke housing are lined up in the mid position (Fig. 3.7) (photo).

3 Start the engine and when fully warmed up, check that the choke valve has fully opened.

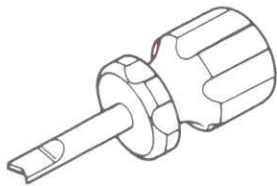


Fig. 3.6 Special screwdriver to turn idle mixture screw (Sec 10)

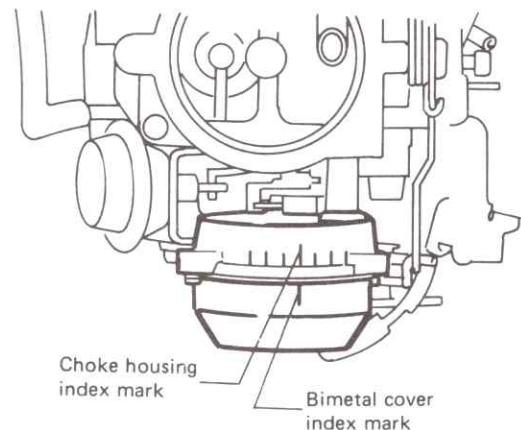
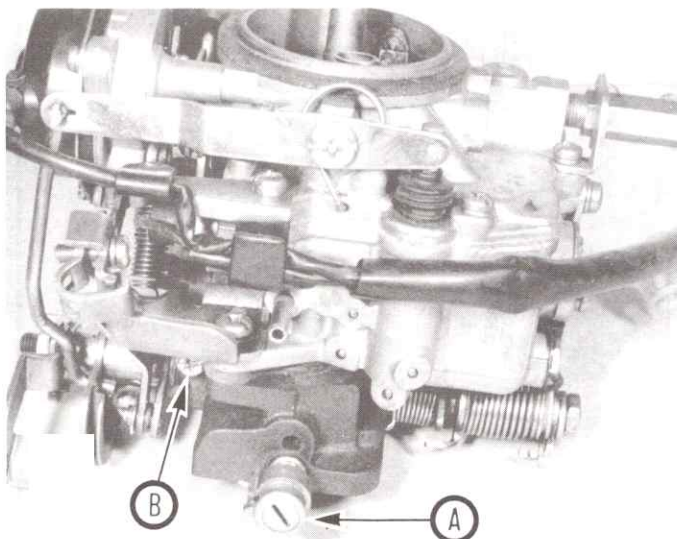
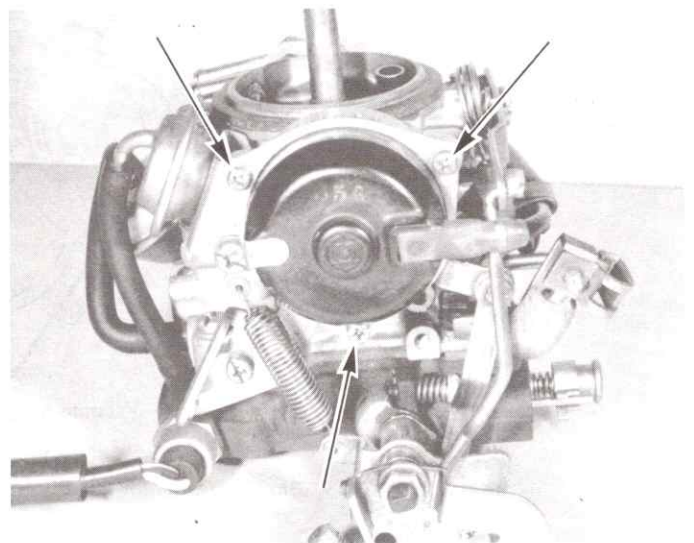


Fig. 3.7 Index marks on automatic choke housing (Sec 11)



10.2 Idle mixture screw A and throttle speed screw B



11.2 Automatic choke bi-metal housing showing securing screws (arrowed)

- 4 Stop the engine, remove the choke housing cover and set the fast idle lever on the second stop of the fast idle cam.
- 5 Start the engine and check that the idle speed is as specified. If not adjust on the fast idle adjusting screw (Fig. 3.8).

#### Vacuum break

- 6 With the engine cold, remove the air cleaner and close the choke valve plate.

- 7 Depress the diaphragm rod fully and then check the clearance R is as specified (Fig. 3.10). The clearance is measured between the edge of the valve plate and the wall of the carburettor. To adjust bend the choke lever.

#### Choke unloader (automatic choke)

- 8 With the engine cold remove the air cleaner and automatic choke housing cover, and close the choke valve plate.

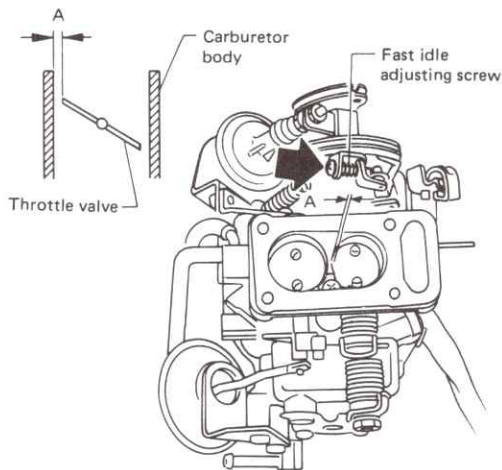


Fig. 3.8 Fast idle adjusting screw (Sec 11)

- $A = 0.44 \pm 0.07 \text{ mm } (0.0173 \pm 0.0028 \text{ in})$   
for manual transmission
- $A = 0.62 \pm 0.07 \text{ mm } (0.0244 \pm 0.0028 \text{ in})$   
for automatic transmission

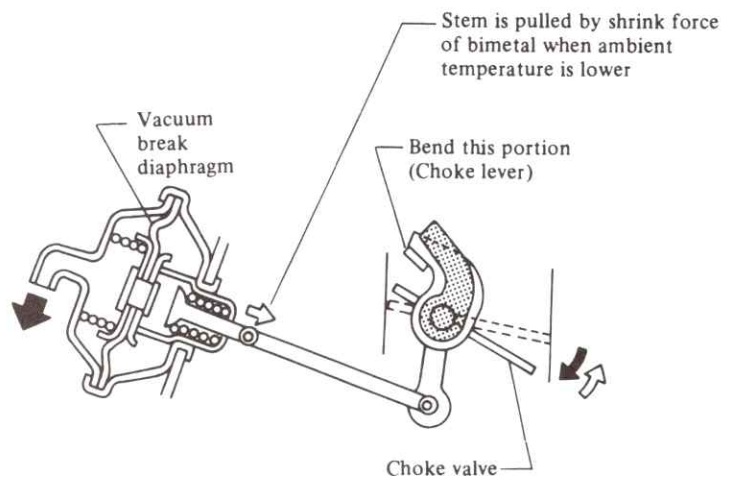


Fig. 3.9 Vacuum break diaphragm (Sec 11)

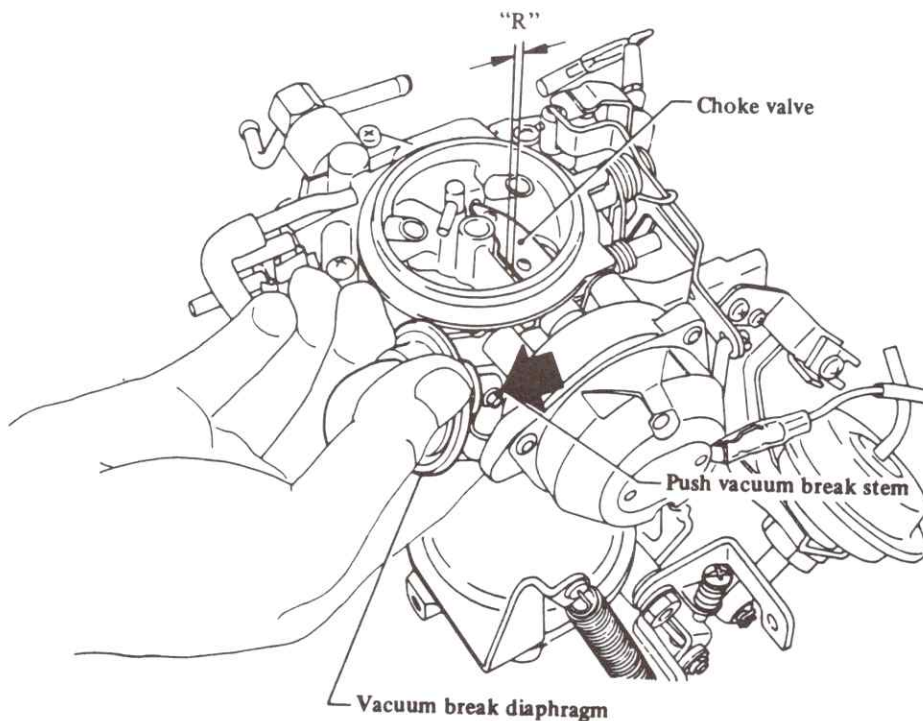


Fig. 3.10 Checking vacuum break adjustment (Sec 11)

$$R = 1.26 \pm 0.09 \text{ mm } (0.0496 \pm 0.0035 \text{ in})$$

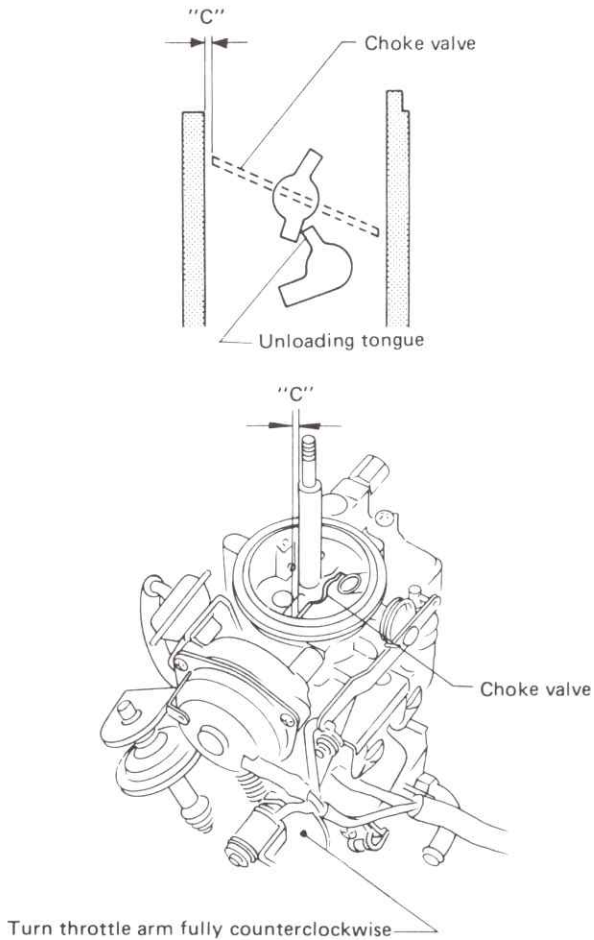


Fig. 3.11 Checking choke unloader setting (Sec 11)

$$C = 2.01 \text{ mm } (0.0791 \text{ in})$$

9 Turn the throttle lever until the primary throttle valve is fully open. If the clearance C is not as specified, bend the tongue of the unloader (Fig. 3.11).

#### Primary and secondary valve plate interlock

10 Turn the throttle lever until the throttle arm contacts the lever at point A (Fig. 3.12).

11 Check that the clearance G is as specified. If it is not, bend the tongue on the throttle arm as necessary.

#### Dashpot (automatic transmission)

12 The engine should be idling at normal operating temperature.

13 Turn the throttle lever on the carburettor by hand and have an assistant record the engine speed shown on the tachometer at the point where the dashpot just makes contact with the stop lever. If the speed is not as specified, release the locknut and turn the dashpot rod (Fig. 3.13).

14 Tighten the locknut and make sure that engine speed drops from 2000 to 1000 rpm in approximately 3 seconds.

#### Fast idle – manual choke

15 Remove the carburettor and close the choke valve completely.

16 Measure clearance A between primary throttle valve and inner wall (see Fig. 3.14).

17 Adjust by bending the choke connecting rod if the clearance is outside that specified.

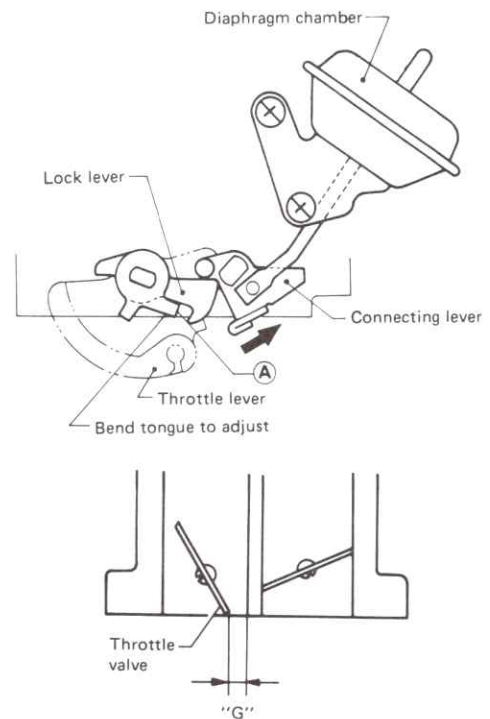


Fig. 3.12 Valve plate interlock setting diagram (Sec 11)

$$G = 5.49 \pm 0.3 \text{ mm } (0.2161 \pm 0.012 \text{ in})$$

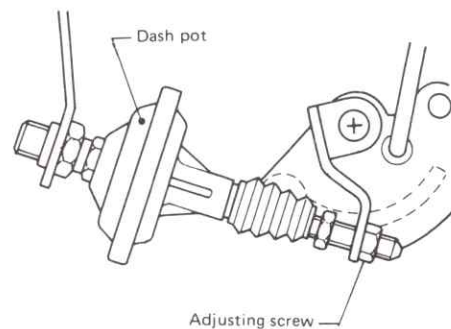


Fig. 3.13 Dashpot adjustment (Sec 11)

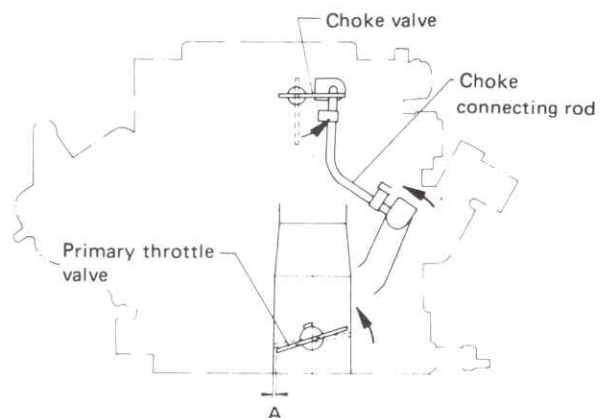


Fig. 3.14 Fast idle adjustment – manual choke (Sec 11)

$$A = 1.33 \pm 0.07 \text{ mm } (0.0524 \pm 0.0028 \text{ in})$$

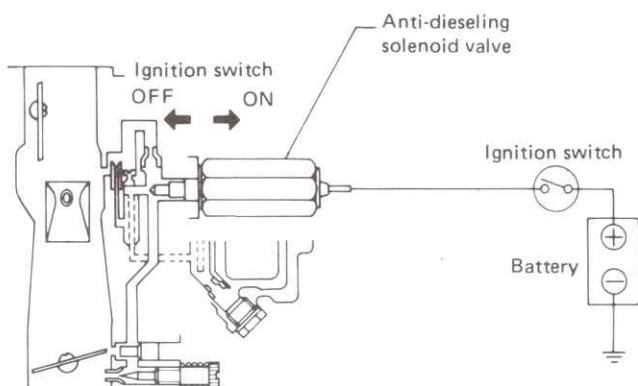


Fig. 3.15 Diagram of anti-dieseling valve (Sec 11)

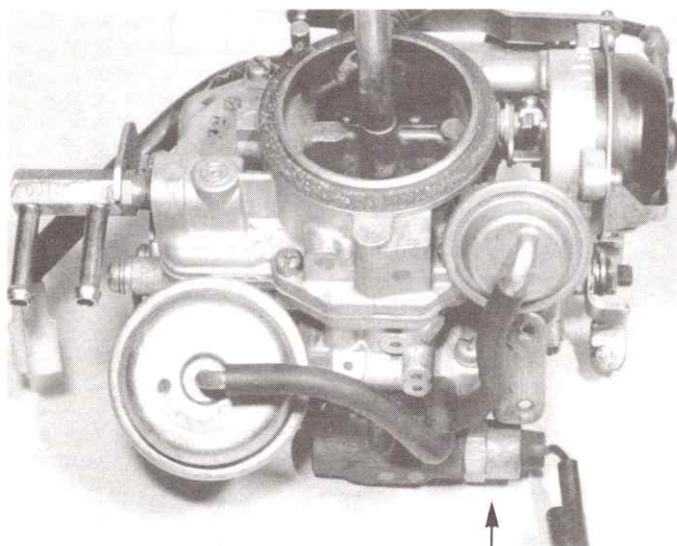
**Anti-dieseling valve**

18 If the engine continues running when the anti-dieseling valve electrical connector is disconnected, the valve has stuck.

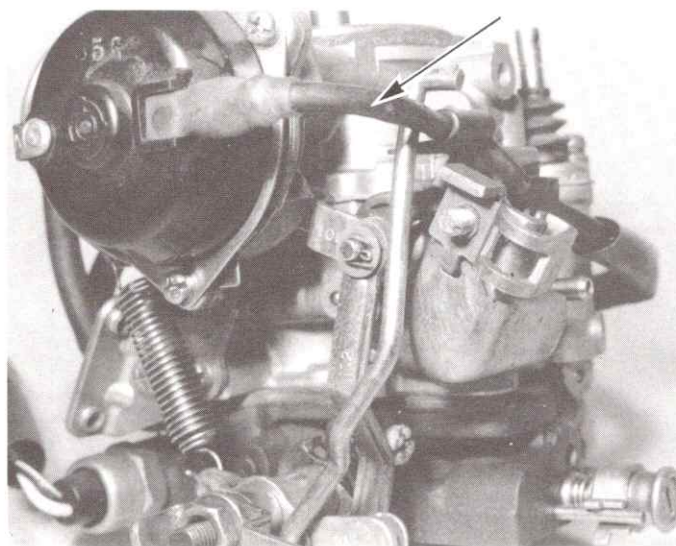
19 To check, connect the valve electrical connections direct to the battery, and listen for a clicking sound. If there is none, renew the valve (photo).

**12 Carburettor – removal**

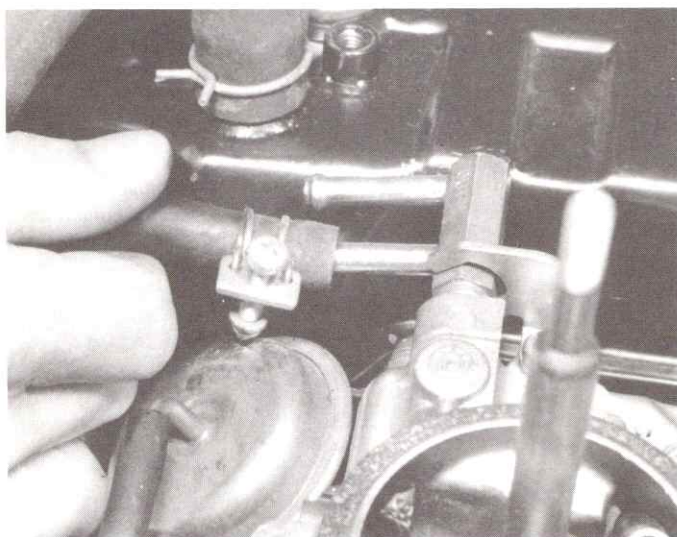
- 1 Disconnect the battery, and remove the air filter assembly.
- 2 Disconnect the accelerator control cable from the carburettor.
- 3 Disconnect the electrical lead (automatic choke) (photo) or the choke cable (manual choke).
- 4 Disconnect the lead to the anti-dieseling valve solenoid.
- 5 Disconnect and plug the inlet and outlet fuel hoses (photo).
- 6 Disconnect the vacuum pipes (photo).
- 7 The carburettor retaining bolts are reached from under the inlet manifold (photo). Undo the retaining bolts and remove the carburettor.



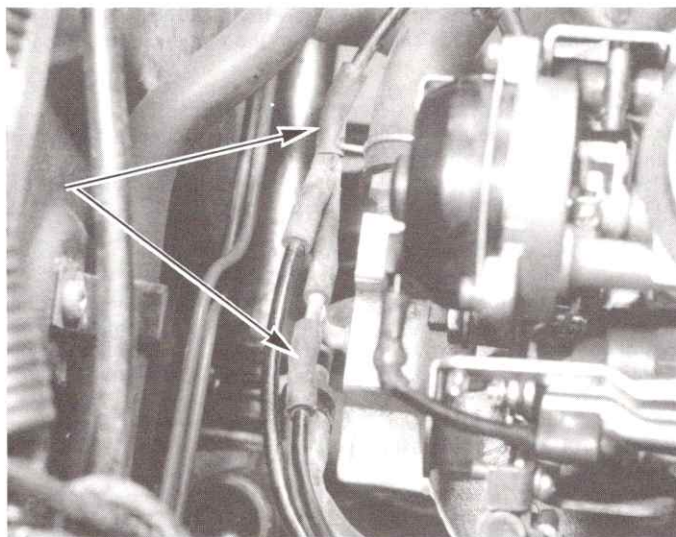
11.19 Anti-dieseling valve



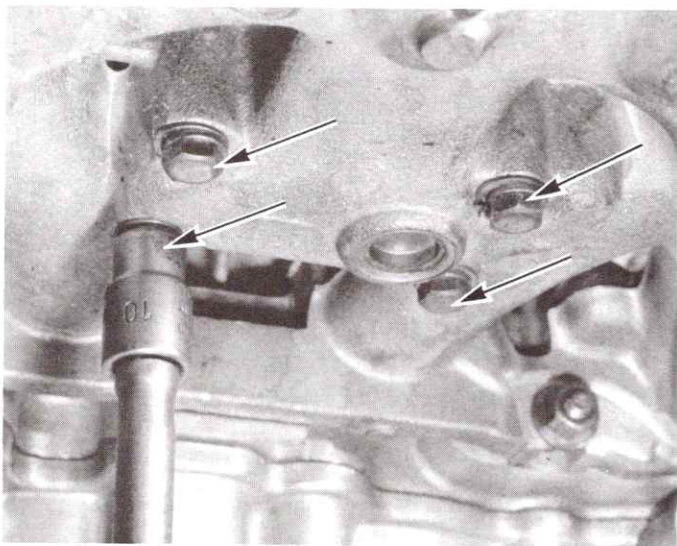
12.3 Electrical lead to automatic choke



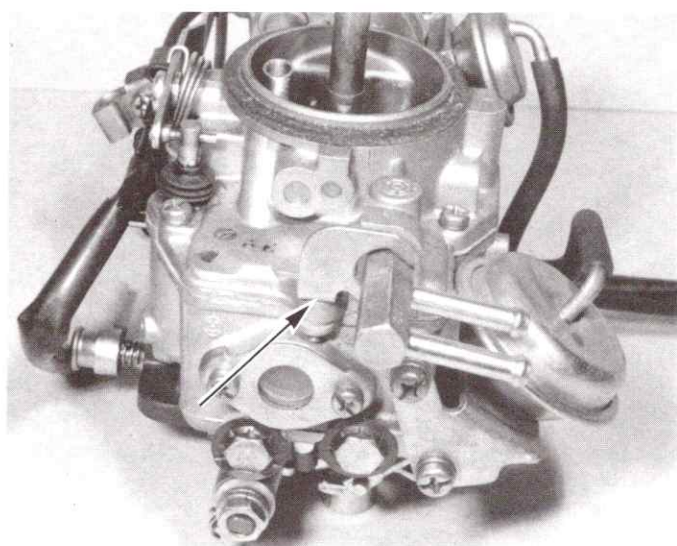
12.5 Inlet and outlet fuel hoses



12.6 The vacuum hoses (arrowed)



12.7 Carburettor mounting bolts under inlet manifold



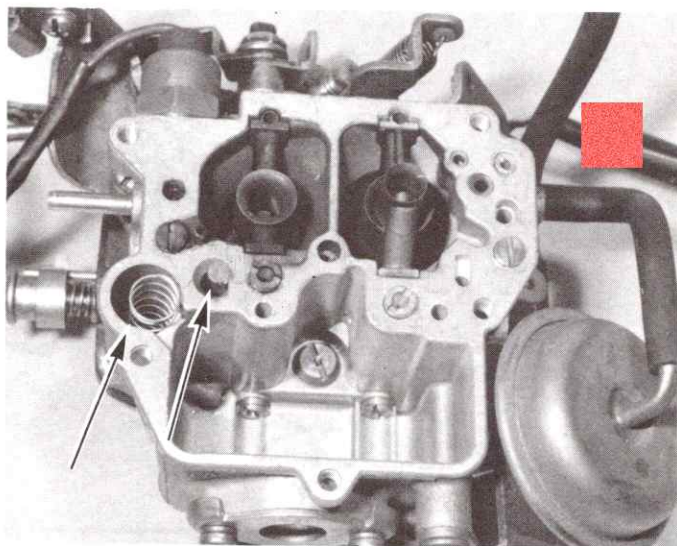
13.3 Top cover retaining screws and inlet/outlet union locking plate

### 13 Carburettor – overhaul

- 1 Clean the exterior of the carburettor thoroughly using petrol or proprietary engine cleaner. Dirt entry into the carburettor can be disastrous.
- 2 The need to strip a carburettor to this level other than to clean jets or set float level indicates that the carburettor parts such as choke and throttle spindles and bushes are worn. It is almost certain therefore that a reconditioned replacement unit would be more economical in the long term than trying to repair a worn carburettor.
- 3 Remove the top cover retaining screws, there are five of them, and gently lift off the top cover. Note the inlet and outlet union locking plate under one of them (photo).
- 4 The float and fuel inlet needle valve can be removed from the top cover by pushing out the float pivot arm.
- 5 Clean out the float chamber, being careful not to lose any springs, pistons or steel balls. Keep a note of where the parts are fitted and which way round they fit (photo).
- 6 Clean out the jets and bearings using compressed air, never use wire to probe the jets. Tiny scratches can play havoc with carburettor settings. Jet sizes can be checked by quoting your carburettor index number to your dealer.
- 7 Carburettor overhaul kits contain all the necessary seals, gaskets and washers required. Renew items as needed, and check the following adjustments on reassembly. A twist drill is very useful for measuring throttle and choke plate clearances.

#### Float level

- 8 The level of fuel in the float chamber, which is controlled by the action of the float lever arm on the inlet valve, can be checked externally.
- 9 Stand the vehicle on level ground, with the engine idling, and check that the fuel level is as shown in Fig. 3.16 through the sight glass on the side of the carburettor (photo).
- 10 If it is not as shown carry out the following adjustments.
- 11 Remove the carburettor top cover as described earlier in this Section.
- 12 The float can be removed by extracting the pivot pin. Shake the float to hear if it is punctured and contains fuel (photo).
- 13 Remove the inlet needle valve and clean it (photo 13.12).
- 14 Refit both the needle valve and float.
- 15 With the top cover inverted and horizontal, measure the distance H from the top face of the float to the inner face of the cover. If it is not as specified, adjust by bending the float seat (photo) and Fig. 3.17.
- 16 Now turn the top cover over and allow the float to hang free. Again measure distance H. If out of adjustment bend the float stopper (photo) and Fig. 3.18.



13.5 Beware of losing springs, pistons and steel balls

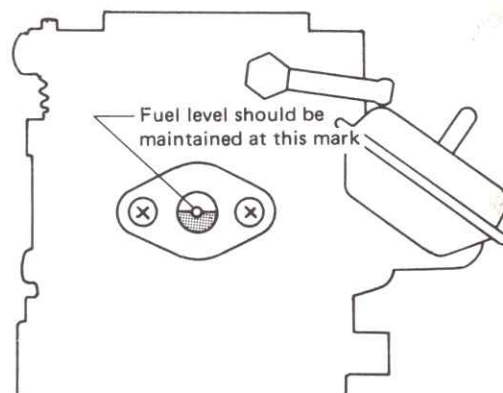
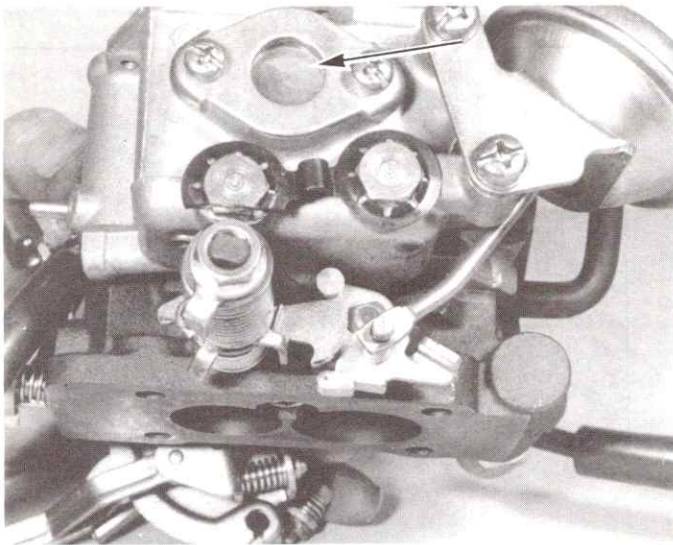
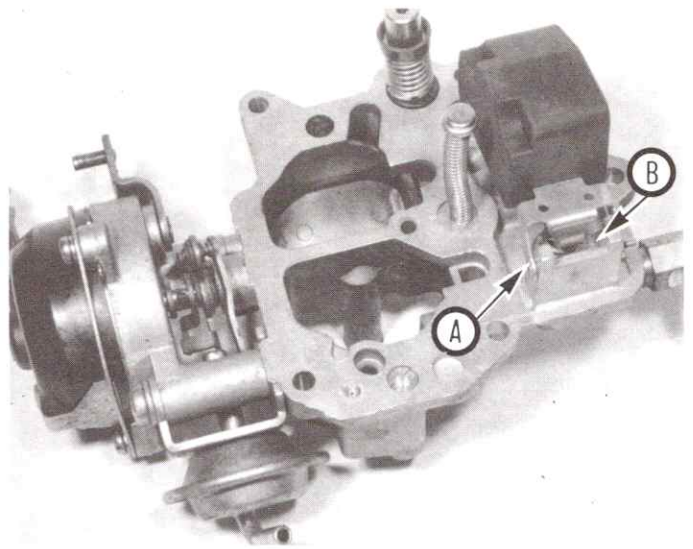


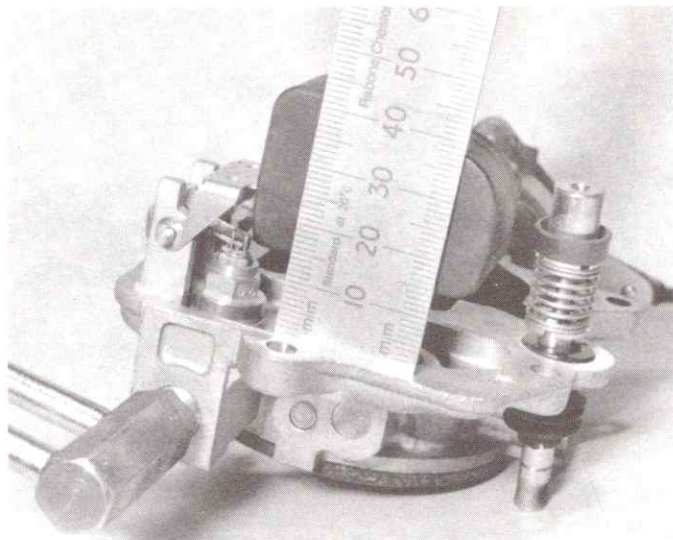
Fig. 3.16 Fuel level in float chamber (Sec 13)



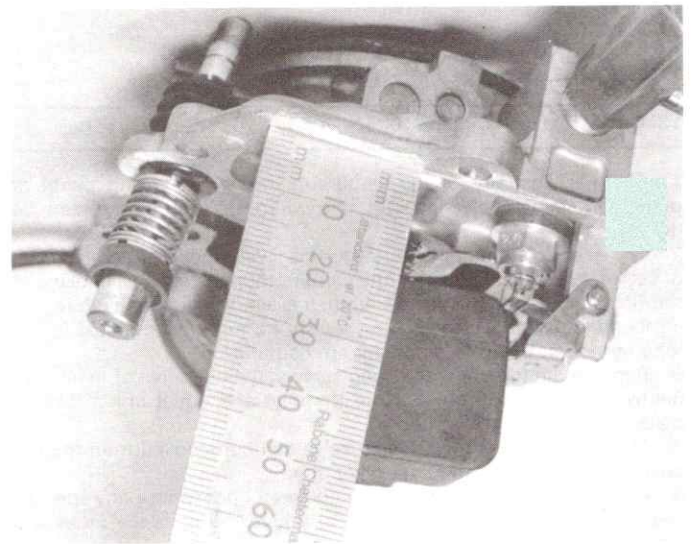
13.9 Fuel level sight glass



13.12 Float pivot pin A and below it the inlet needle valve B



13.15 Measuring top float position



13.16 Measuring bottom float position

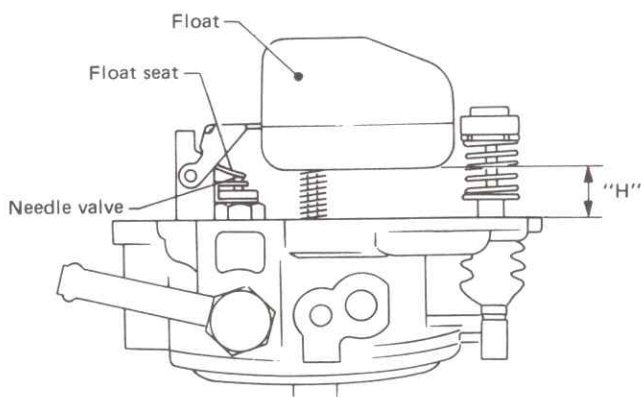


Fig. 3.17 Top float position (Sec 13)

$$H = 14 \text{ mm (0.55 in)}$$

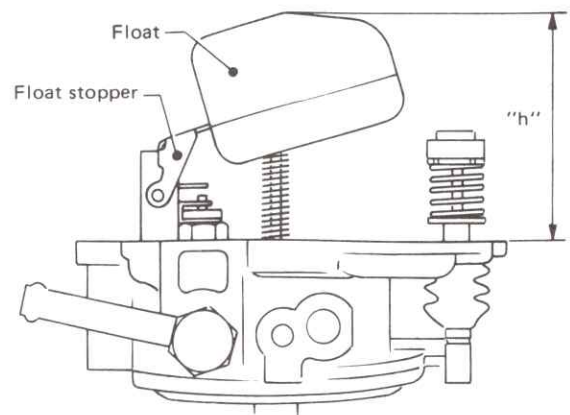


Fig. 3.18 Bottom float position (Sec 13)

$$h = 46 \text{ mm (1.81 in)}$$

17 Refit the cover as described later in this Section and recheck the fuel level as previously described.

#### *Accelerator pump*

18 With the engine stopped and the carburettor float bowl full operate the accelerator pump by opening the throttle lever.

19 Observe that the pump injects fuel into the primary venturi, smoothly and without delay.

20 If this is not the case, check the pump and linkage for wear or damage.

#### *Assembly*

21 Use a new gasket when refitting the top cover, and ensure all springs, pistons and steel balls are in their correct location.

---

### 14 Carburettor – refitting

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1 Refitting the carburettor is largely a matter of reversing the removal operations in Section 12.

2 Use a new gasket on the inlet manifold (photo).

3 Make sure the inlet and outlet hoses are connected to the correct union (photo).

4 Reconnect all breather hoses, vacuum pipes and electrical leads as applicable.

5 Refit the air filter assembly.

6 Check accelerator and choke cable for correct adjustment.

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### 15 Emission control system – general

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The emission control system consists of the crankcase ventilation system, described in Chapter 1, and the idle compensator device described in Section 6 of this Chapter.

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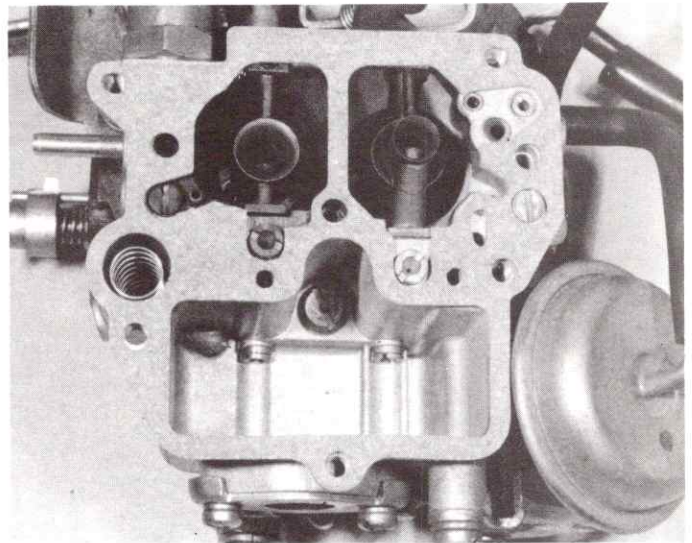
### 16 Accelerator pedal and cable – removal, refitting and adjustment

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#### *Pedal*

1 Release the cable from the top of the pedal arm.

2 Extract the E-clip from the pedal pivot shaft, disengage the return spring and remove the pedal.



13.21 Top cover gasket in position before fitting top cover

3 Refitting is a reversal of removal, but apply grease to the moving parts.

#### *Cable*

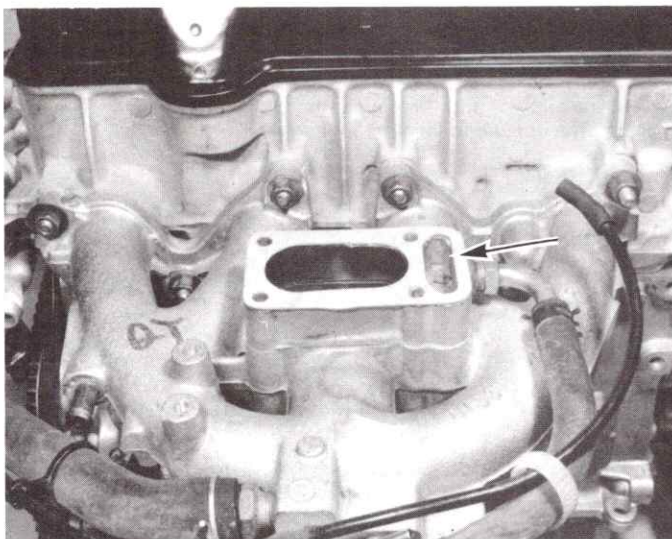
4 Disconnect the cable from the top of the pedal arm.

5 Release the plastic grommet at the engine compartment rear bulkhead.

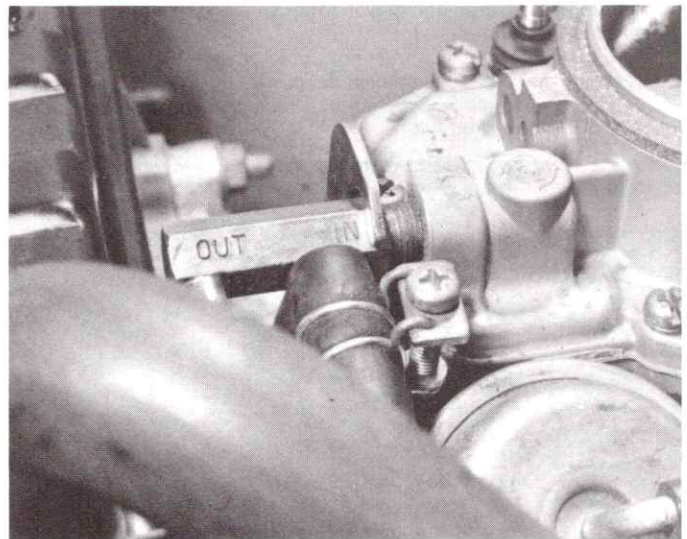
6 Disconnect the cable at the throttle and then withdraw it into the engine compartment.

7 Fit the new cable by reversing the removal operations. Adjust it by moving the position of the outer cable clamp to give the correct free movement at the pedal pad (see Fig. 3.19). Make sure that the automatic choke valve plate is fully open before adjusting the cable (if applicable).

8 On vehicles equipped with automatic transmission, check that the pedal can be depressed fully into the kickdown position (also refer to Chapter 7).



14.2 Use a new gasket when refitting



14.3 Inlet and outlet fuel union

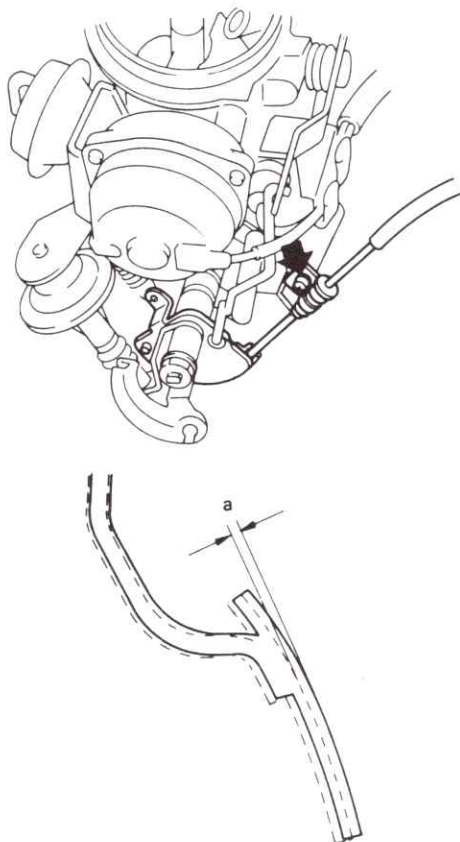


Fig. 3.19 Throttle cable adjustment (Sec 16)

$a = 1 \text{ to } 3 \text{ mm (0.04 to 0.12 in)}$

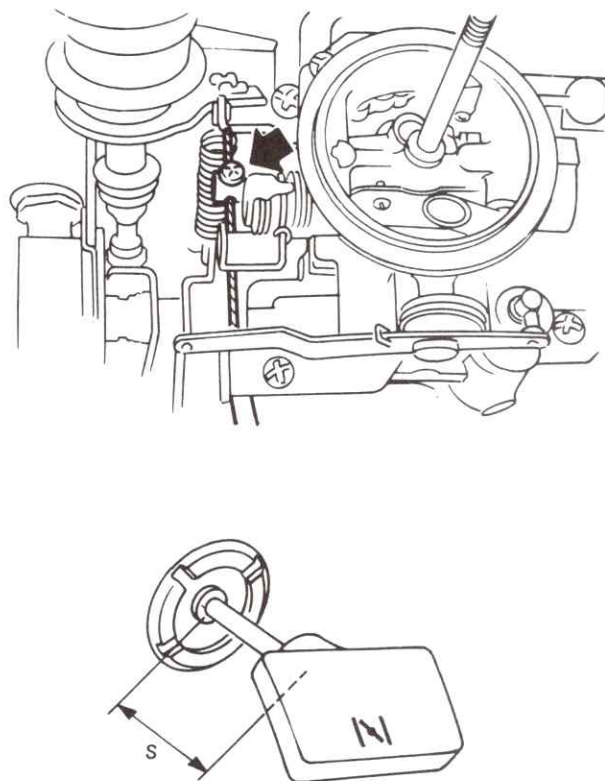


Fig. 3.20 Choke cable adjustment (Sec 17)

$S = 21 \text{ to } 25 \text{ mm (0.83 to 0.98 in)}$

### 17 Choke control cable – removal and refitting

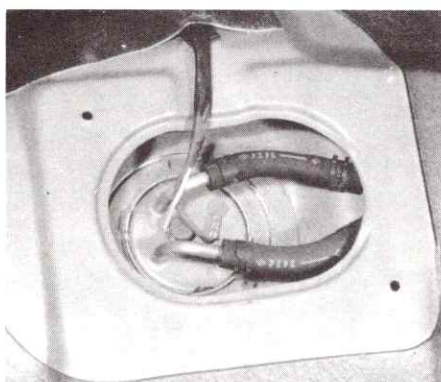
- 1 Remove the air filter assembly from the carburettor, release the cable pinch screw on the trunnion at the carburettor and the cable clamp screw.
- 2 Working inside the vehicle at the fascia panel, unscrew the choke control knob bezel nut and withdraw the cable into the vehicle interior. If a choke warning lamp switch is fitted, disconnect the electrical leads.
- 3 Refitting is a reversal of removal. Make sure that the bulkhead cable grommet makes a good seal.
- 4 With the cable in position, do not tighten the pinch screw until the choke control knob has been pulled out by about 0.83 to 0.98 in (21 to 25 mm) and the choke valve plate has been checked as being in the fully open position (Fig. 3.20).

### 18 Fuel tank – removal, repair and refitting

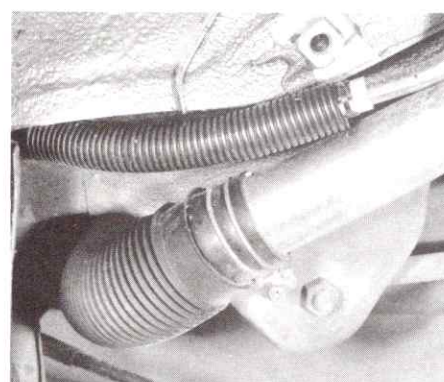
- 1 Jack up the rear of the car and support on axle stands, then drain the fuel by unscrewing the drain plug from the base of the tank.
- 2 Working within the luggage compartment, remove the cover plate from the tank transmitter unit and then disconnect the wiring harness plug (photos).
- 3 Disconnect the battery.
- 4 Working under the rear wing, disconnect the fuel filler and ventilation hoses (photo). Stuff a piece of rag into the openings to prevent the entry of dirt. If required, the filler pipe can be removed by removing the upper and lower mounting plates.



18.2A Removing the fuel tank transmitter cover



18.2B Disconnect the electrical lead



18.4 Fuel filter and vent hose connections

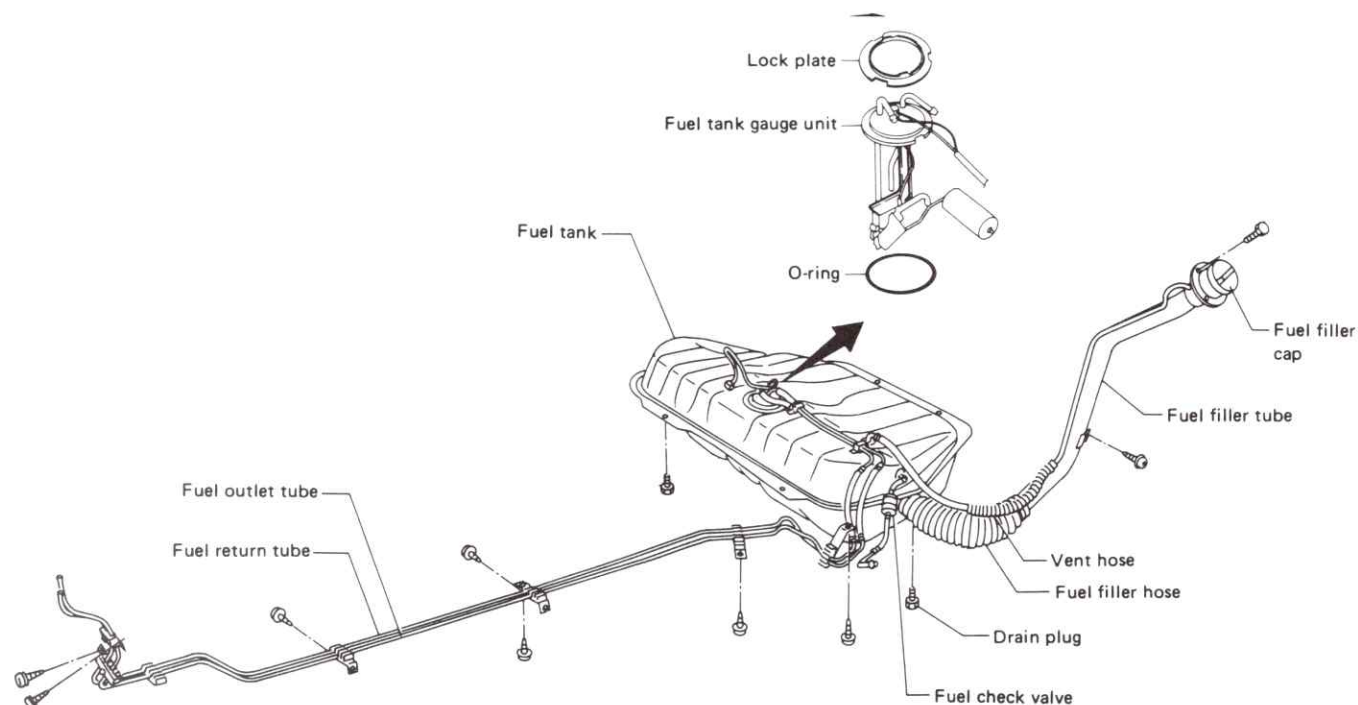


Fig. 3.21 Fuel tank and components (Sec 18)

5 Working at the front of the fuel tank, disconnect the fuel flow and return hoses.

6 Support the tank and then unscrew and remove the six mounting bolts from the tank flange (photo). Lower and remove the tank from the vehicle.

7 A leak in a fuel tank can be sealed using one of the several products available at motor accessory stores. For a permanent repair the tank will have to be soldered or brazed, but *on no account attempt to do this work yourself* owing to the risk of explosion unless the tank has been

steamed out thoroughly. Radiator repairers can usually undertake fuel tank repair work.

8 Removal of sediment, water or sludge can be carried out after first having removed the tank transmitter unit. Pour in some paraffin, or petrol, and shake the tank vigorously. Empty the tank and repeat the operations as many times as is necessary to clean it and then give a final rinse with clean fuel.

9 Refitting is a reversal of removal.

### 19 Exhaust system – removal and refitting

1 The exhaust system can be broken down into three parts, the exhaust manifold (described in Chapter 1) the downpipe and intermediate silencer, and the rear silencer.

2 Should any part become corroded and holed, the whole system should be replaced.

3 The time and effort required to replace an exhaust system is hardly worthwhile, with so many quick fit specialists around.

4 Should you decide to do the job yourself, then proceed as follows.

5 Soak all clamp and mounting bolts in releasing fluid. Do not waste time in removing these. If they are so corroded they will not budge, then cut them off with a hacksaw.

6 Undo the exhaust downpipe connection at the manifold.

7 Undo the intermediate pipe clamp (photo).

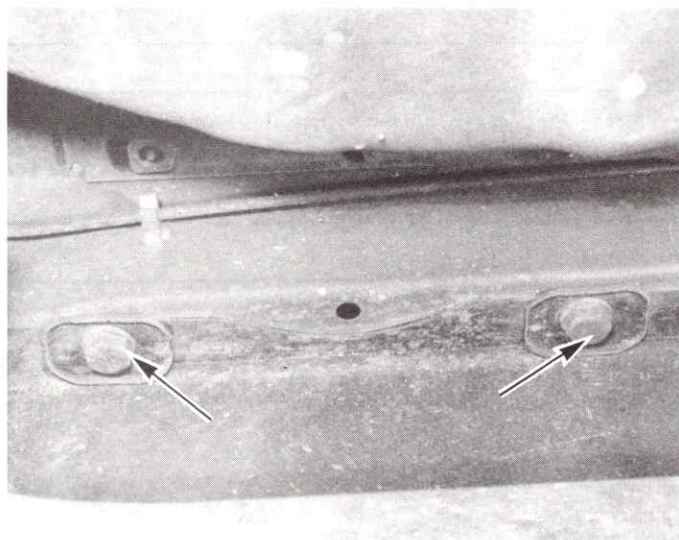
8 Undo the intermediate silencer mounting (photo).

9 Undo the rear silencer mounting (photo).

10 Refit the new exhaust, starting at the exhaust manifold and working rearwards.

11 Use a proprietary sealing compound for exhaust joints, and fit everything loosely until the parts can be properly lined up and are not under stress.

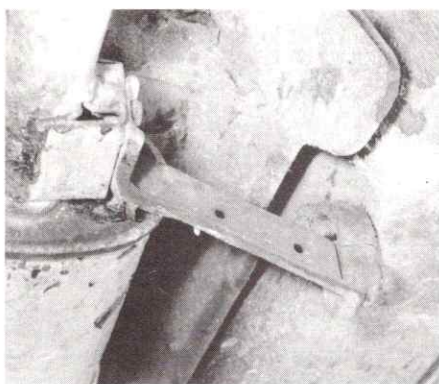
12 Tighten all mounting bolts and clamps, then run the engine and check for leaks.



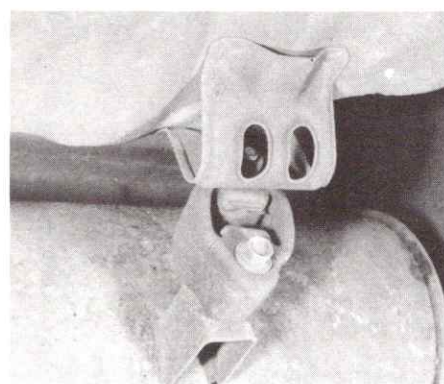
18.6 Fuel tank mounting bolts (there are six altogether)



19.7 Intermediate exhaust pipe clamp



19.8 Intermediate silencer mounting



19.9 Rear silencer mounting

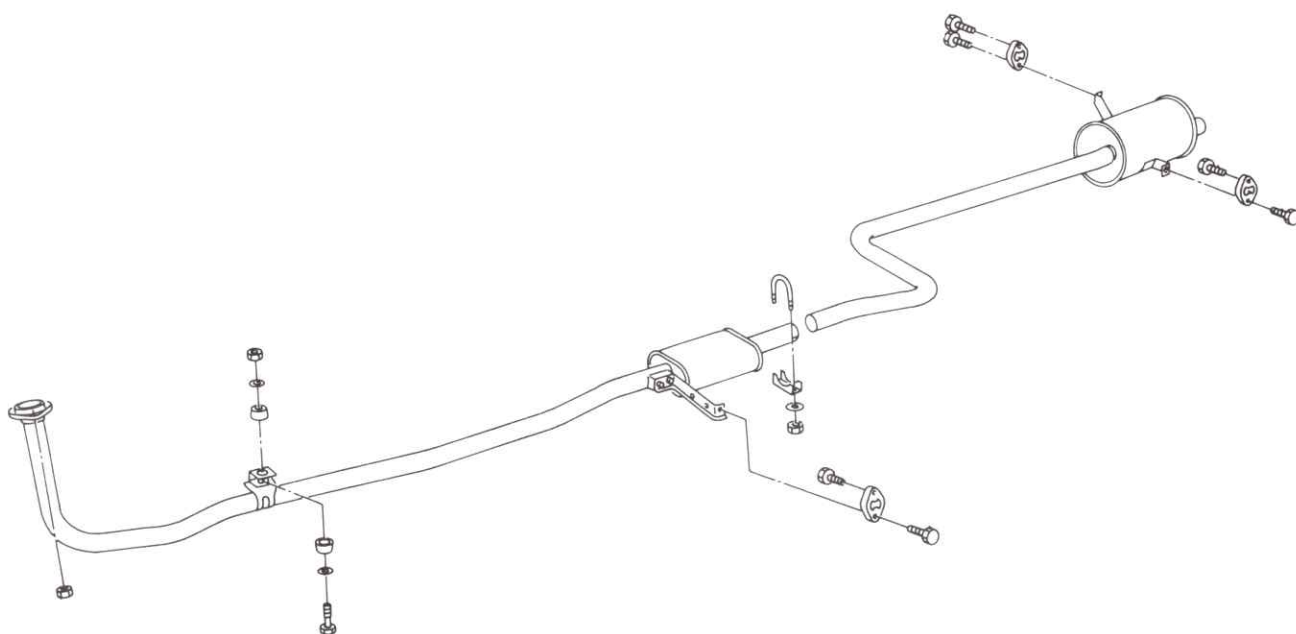


Fig. 3.22 Exhaust system components (Sec 19)

## 20 Fault diagnosis – fuel, exhaust and emission control systems

*Unsatisfactory engine performance and excessive fuel consumption are not necessarily the fault of the fuel system or carburettor. In fact they more commonly occur as a result of ignition and timing faults. Before acting on the following it is necessary to check the ignition system first. Even though fault may lie in the fuel system it will be difficult to trace unless the ignition is correct. The faults below, therefore, assume that this has been attended to first (where appropriate).*

Symptom	Reason(s)
Smell of fuel when engine is stopped	Leaking fuel lines or unions Leaking fuel tank
Smell of fuel when engine is idling	Leaking fuel line unions between pump and carburettor injectors Overflow of fuel from float chamber due to wrong level setting, ineffective needle valve or punctured float
Excessive fuel consumption for reasons not covered by leaks or float chamber faults	Worn jets Over-rich setting Sticking mechanism Dirty air cleaner element Sticking air cleaner thermostatic mechanism

Symptom	Reason(s)
Difficult starting, uneven running, lack of power, cutting out	One or more jets blocked or restricted Float chamber fuel level too low or needle valve sticking Fuel pump not delivering sufficient fuel Faulty solenoid fuel shut-off valve (if fitted) Induction leak
Difficult starting when cold	Choke control or automatic choke maladjusted Automatic choke not cocked before starting
Difficult starting when hot	Automatic choke malfunction Accelerator pedal pumped before starting Vapour lock (especially in hot weather or at high altitude)
Engine does not respond properly to throttle	Faulty accelerator pump Blocked jet(s) Slack in accelerator cable
Engine idle speed drops when hot	Defective temperature compensator Overheated fuel pump
<i>Emission control system</i>	
Excessive HC or CO in exhaust gas	Air cleaner clogged Float level too high Faulty spark control system Faulty throttle opener control system Leaking intake manifold gasket
Excessive HC, CO and NOx in exhaust gas	Worn piston rings Incorrect valve clearances Fault thermostat Blown cylinder head gasket Clogged PCV valve Incorrect idle mixture Clogged fuel filter Faulty idle compensator Choke not fully off Incorrect ignition settings Malfunction of emission control system component

HC Hydrocarbons  
CO Carbon monoxide  
NOx Nitrogen oxide

# Chapter 4 Ignition system

## Contents

Coil – description and testing .....	11	Fault diagnosis – ignition system .....	12
Condenser – testing, removal and refitting .....	5	General description .....	1
Contact breaker points – servicing and adjustment .....	3	Ignition timing – adjustment .....	8
Distributor – overhaul .....	7	Routine maintenance .....	2
Distributor – removal and refitting .....	6	Spark plugs, HT leads and distributor cap – general .....	10
Dwell angle – checking and adjusting .....	4	Timing procedures – static and dynamic .....	9

## Specifications

<b>System type</b> .....	Conventional with coil and contact breaker points		
<b>Distributor</b>			
Firing order .....	1 – 3 – 4 – 2 (No 1 at timing belt end)		
Rotation of rotor .....	Anti-clockwise		
Minimum protrusion of carbon brush .....	3 mm (0.12 in)		
Contact breaker point gap .....	0.45 to 0.55 mm (0.018 to 0.022 in)		
Dwell angle .....	49° to 55°		
<b>Coil</b>			
Primary resistance .....	1.3 to 1.5 ohm		
Secondary resistance .....	8.7 to 11.7 k ohm		
<b>Ignition timing</b>			
Four-speed manual transmission .....	2° ± 1° ATDC at idle speed with distributor vacuum hose disconnected		
All other models .....	5° ± 1° BTDC at idle speed with distributor vacuum hose disconnected		
<b>Spark plugs</b>			
Type .....	NGK BPR 5 ES or Champion RN 9YC		
Gap .....	0.8 to 0.9 mm (0.031 to 0.035 in)		
<b>Torque wrench setting</b>			
Spark plug .....	lbf ft	kgf m	
	18 to 22	2.5 to 3.0	

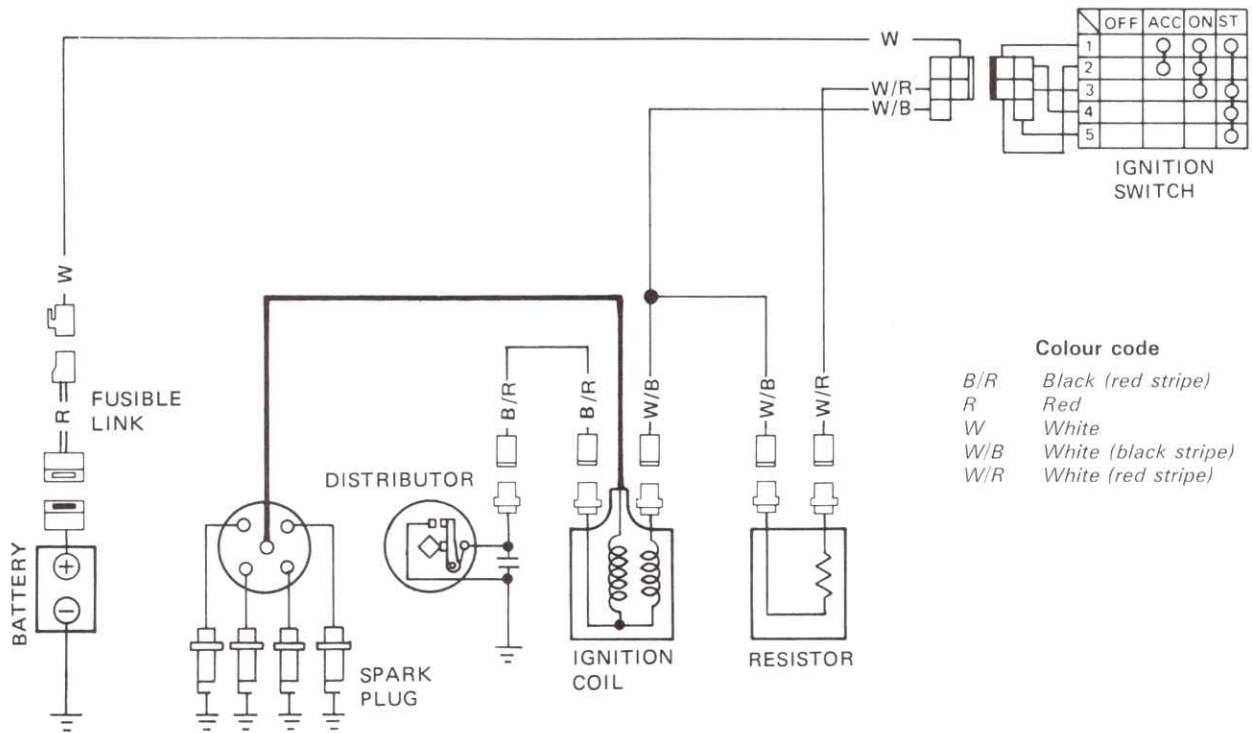


Fig. 4.1 Wiring diagram of ignition circuit (Sec 1)

### 1 General description

The ignition system is conventional in design consisting of coil, the distributor, which incorporates the contact points, and the spark plugs, one in each cylinder.

The ignition system is based on feeding low tension voltage from the battery to the coil where it is converted to high tension voltage. The high tension voltage is powerful enough to jump the spark plug gap in the cylinders many times a second under high compression pressures, providing that the system is in good condition and that all adjustments are correct.

The ignition advance is controlled both mechanically and by vacuum, to ensure that the spark occurs at just the right instant for the particular engine load and speed. The mechanical governor comprises two lead weights, which move out from the distributor shaft as the engine speed rises, due to centrifugal force.

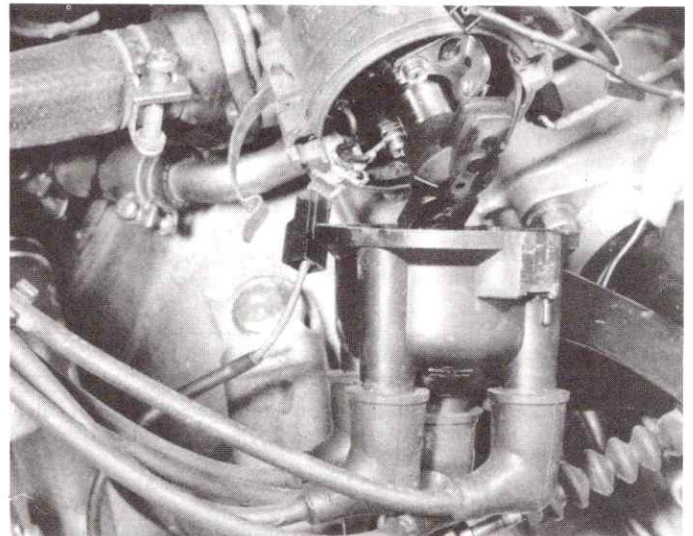
The vacuum control consists of a diaphragm, one side of which is connected via a small bore tube to the carburettor, and the other side to the contact breaker plate. Depression in the inlet manifold and carburettor, which varies with engine speed and throttle opening, causes the diaphragm to move, so moving the contact breaker plate, and advancing or retarding the spark.

### 2 Routine maintenance

- 1 Every 6000 miles (10 000 km) or 6 months, whichever comes sooner, check and adjust as necessary the ignition timing. Also check the distributor contact points and the spark plugs.
- 2 Every 12 000 miles (20 000 km) or 12 months, whichever comes sooner, renew the contact breaker points and spark plugs.
- 3 Every 24 000 miles (40 000 km) or 24 months whichever comes sooner, check the condition of all ignition wiring and associated components, and renew as necessary.

### 3 Contact breaker points – servicing and adjustment

- 1 The contact breaker points should be serviced and adjusted as specified in the routine maintenance Section.
- 2 Remove the distributor cap by unclipping the two securing clips and pulling the cap and HT leads to one side (there is no need to disconnect these HT leads) (photo).



3.2 Removing the distributor cap

- 3 This will give access to the rotor arm, which should be pulled off the driveshaft. This will give access to the contact breaker points.
  - 4 The point may be gently prised apart and the two contacts examined, one on the fixed plate, the other on the moving spring arm. If they are badly pitted, burnt, or eroded, they should be renewed. If the wear is minimal, the contacts may be dressed clean using fine abrasive paper or by rubbing squarely on an oilstone.
  - 5 To change the contact points, disconnect the LT lead from the terminal on the distributor body.
  - 6 Loosen, but do not remove completely the two screws securing the contact breaker to the base plate (photo).
  - 7 Slide the contact breaker out from under the screw head, and remove it from the distributor.
  - 8 To remove the spring contact arm, extract the circlip from its slot on the post and slide the arm off.
  - 9 New contacts should have their faces cleaned with a solvent, to remove any traces of protective grease before being fitted.
  - 10 Apply a few drops of oil to the pivot post, then fit the spring arm contact and the circlip.
  - 11 Fit the contact breaker assembly back under the two retaining screws, and tighten the screws finger tight only.
  - 12 Re-connect the LT lead.
  - 13 By turning the engine using a spanner on the crankshaft pulley nut, position the heel of the moving spring arm contact on to one of the lobes of the cam on the distributor driveshaft.
  - 14 Now adjust the gap between the two contacts by sliding the fixed contact plate in or out under its two retaining screws, until a feeler gauge set of the correct gap size is a sliding fit between them (photo).
- Note:** a cut-out is provided in the contact plate to enable a screwdriver to be used to lever the plate in or out.
- 15 Once the gap is correct, tighten the two screws, and re-check the gap.
  - 16 Apply a smear of high melting point grease to the lobes of the distributor driveshaft, and oil the felt pad in the recess at the top of the driveshaft with one or two drops of engine oil.
  - 17 Fit the rotor arm, ensuring it seats properly in the location slot, then refit the distributor cap, and two securing clips.
  - 18 Check the HT leads are seating correctly on their location housings.

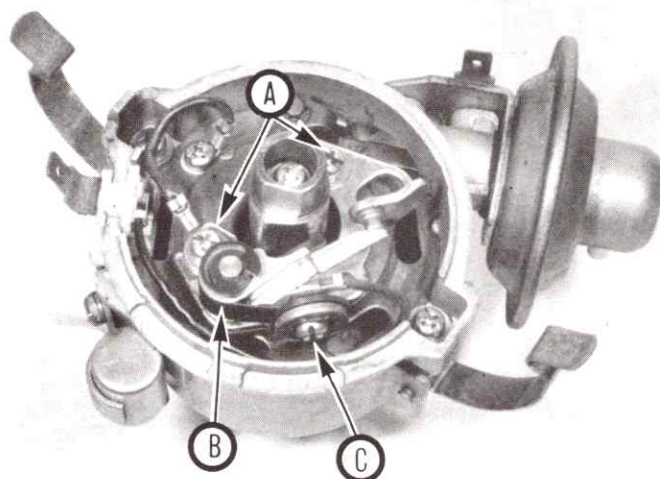
**Note:** This is a basic setting procedure, and should be undertaken in conjunction with more precise methods of setting the ignition timing, described in the following Sections.

#### 4 Dwell angle – checking and adjusting

- 1 The setting of contact breaker points gap using feeler gauges has nowadays become a basic setting only, and more emphasis is placed on the dwell angle.
- 2 The dwell angle may be expressed as the number of degrees through which the distributor driveshaft turns with the contact points closed. The wider the gap, the smaller the dwell angle. Checking the dwell angle gives a more accurate setting of the contact breaker points and tends to even out the effects of wear in the distributor and differences in height between the cam lobes.
- 3 To check the dwell angle requires the use of a dwell meter, connected according to the manufacturer's instructions. Refer to the Specifications for the correct dwell angle.
- 4 With the dwell angle meter connected and the engine running, check the dwell angle. If it is too large, increase the points gap and vice versa. The dwell angle should always be checked before checking and adjusting the ignition timing.

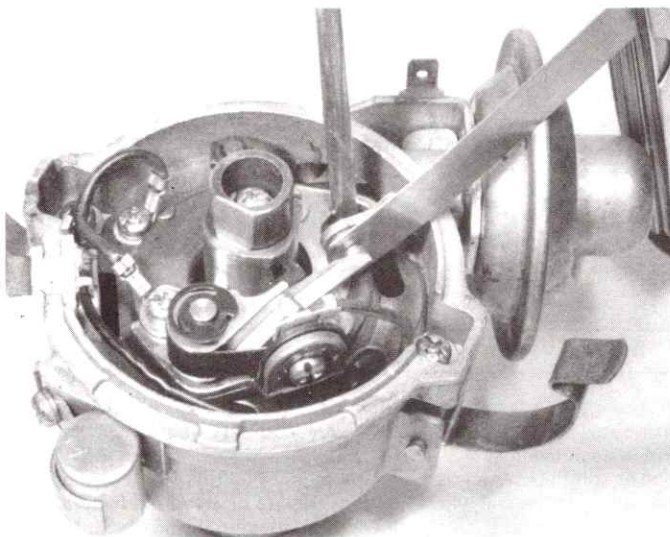
#### 5 Condenser – testing, removal and refitting

- 1 The purpose of the condenser in the ignition system is to reduce sparking across the contact breaker points which would cause wear and loss of voltage.
- 2 The condenser is mounted on the outside of the distributor body, but its lead is terminated inside.
- 3 To remove the condenser, remove the distributor cap and rotor arm and remove the terminal nut from the condenser lead. Remove the screw securing the condenser to the distributor body and remove the condenser.



3.6 Removing the contact breaker points

- A Baseplate securing screws
- B E-Clip
- C LT terminal



3.14 Adjusting the contact breaker points

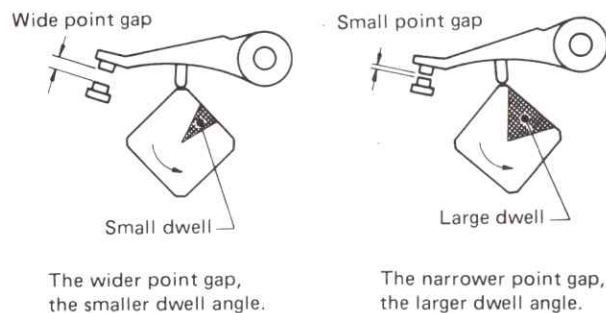
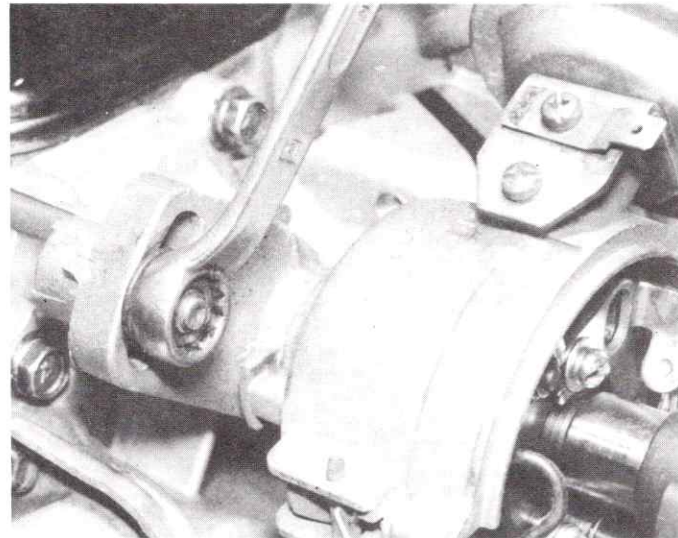


Fig. 4.2 Setting of dwell angle (Sec 4)

- 4 Refitting is a reversal of removal.
- 5 Condensers should be changed along with contact points and spark plugs to ensure optimum performance of the ignition system generally. Poor starting and uneven running can often be traced to a faulty condenser.
- 6 Without special equipment proper fault diagnosis of the condenser is impossible, but an indication that the condenser is in poor condition can be obtained by opening the points while the ignition is switched on. If this results in a strong blue flash, then suspect the condenser of reduced performance.

## 6 Distributor – removal and refitting

- 1 The distributor is mounted on the cylinder head at the left-hand side of the engine.
- 2 Remove the spark plugs and turn the engine so that the 0° mark on the crankshaft pulley is lined up with the pointer on the crankcase.
- 3 Remove the distributor cap and rotor arm, then release the nut securing the distributor to the engine housing (photo).

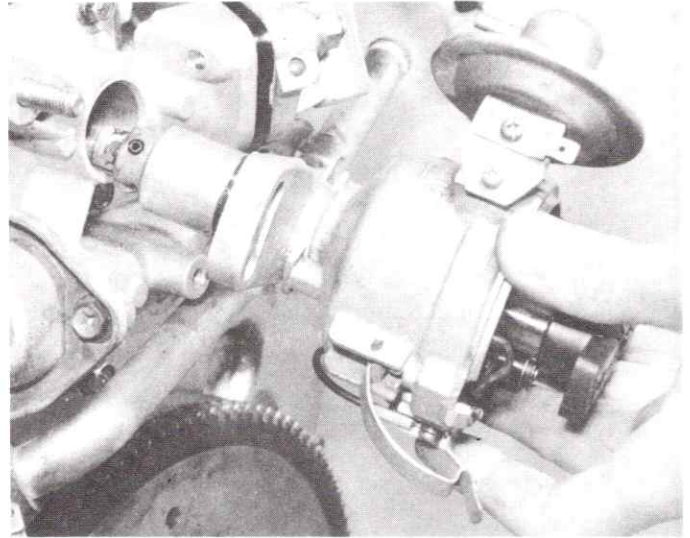


6.3 Removing the distributor securing nut

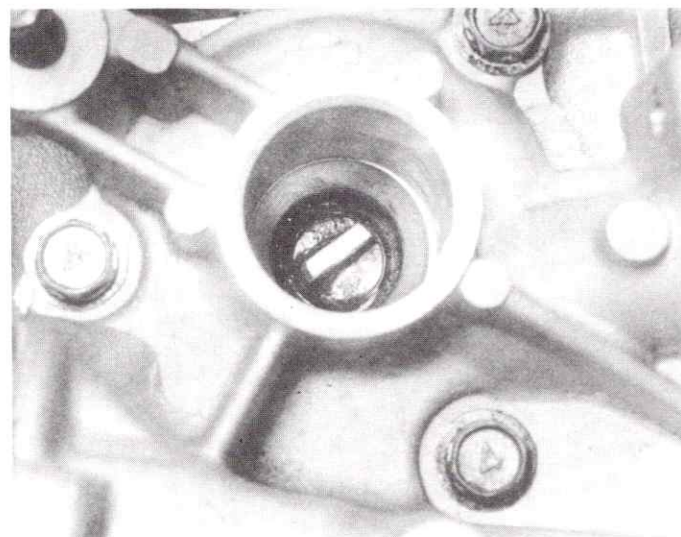
- 4 Pull off the hose to the vacuum unit, and remove the distributor (photo).
- 5 Refitting is a reversal of this operation, but note that the distributor drive tongue and the slot in the distributor driveshaft are off-set, to prevent the distributor being replaced with the timing 180° out (photos).

## 7 Distributor – overhaul

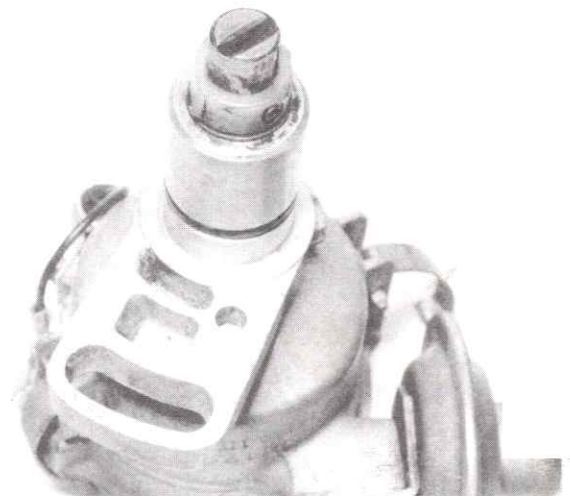
- 1 With the distributor removed from the engine (Section 6), clean away external dirt.
- 2 Prise off the spring clips and take off the cap.
- 3 Pull off the rotor.
- 4 Extract the fixing screws and remove the vacuum advance capsule. It will need tilting in order to release the link rod from the pivot on the baseplate once the E-clip has been prised off the pivot.
- 5 Extract the two screws and remove the baseplate.
- 6 Remove the contact breaker from the baseplate.
- 7 If the contact breaker fixing screws are removed, take care that the



6.4 Removing the distributor



6.5A Distributor drive tongue in engine housing



6.5B Slot in distributor driveshaft

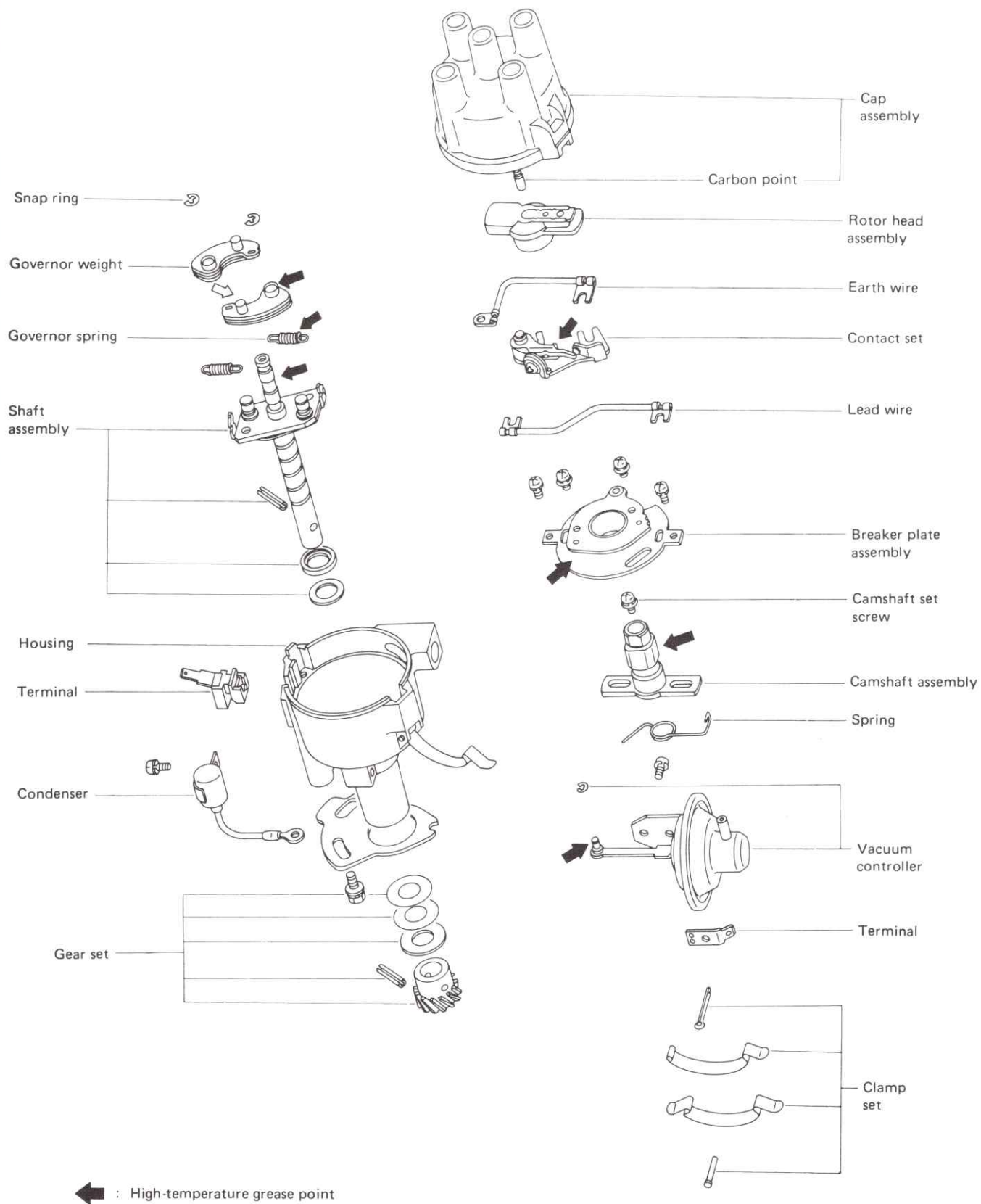
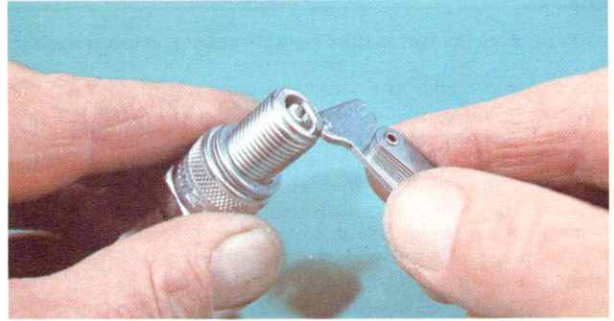


Fig. 4.3 Exploded view of the distributor (Sec 7)



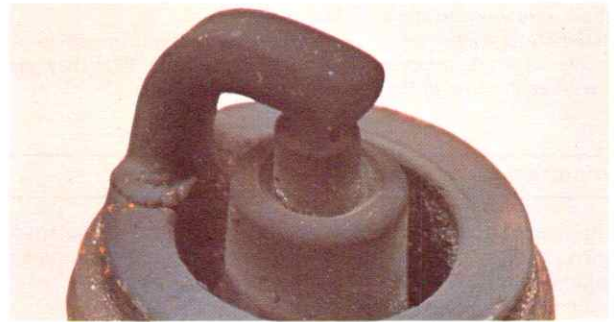
**Measuring plug gap.** A feeler gauge of the correct size (see ignition system specifications) should have a slight 'drag' when slid between the electrodes. Adjust gap if necessary



**Adjusting plug gap.** The plug gap is adjusted by bending the earth electrode inwards, or outwards, as necessary until the correct clearance is obtained. Note the use of the correct tool



**Normal.** Grey-brown deposits, lightly coated core nose. Gap increasing by around 0.001 in (0.025 mm) per 1000 miles (1600 km). Plugs ideally suited to engine, and engine in good condition



**Carbon fouling.** Dry, black, sooty deposits. Will cause weak spark and eventually misfire. Fault: over-rich fuel mixture. Check: carburettor mixture settings, float level and jet sizes; choke operation and cleanliness of air filter. Plugs can be re-used after cleaning



**Oil fouling.** Wet, oily deposits. Will cause weak spark and eventually misfire. Fault: worn bores/piston rings or valve guides; sometimes occurs (temporarily) during running-in period. Plugs can be re-used after thorough cleaning



**Overheating.** Electrodes have glazed appearance, core nose very white – few deposits. Fault: plug overheating. Check: plug value, ignition timing, fuel octane rating (too low) and fuel mixture (too weak). Discard plugs and cure fault immediately



**Electrode damage.** Electrodes burned away; core nose has burned, glazed appearance. Fault: pre-ignition. Check: as for 'Overheating' but may be more severe. Discard plugs and remedy fault before piston or valve damage occurs



**Split core nose (may appear initially as a crack).** Damage is self-evident, but cracks will only show after cleaning. Fault: pre-ignition or wrong gap-setting technique. Check: ignition timing, cooling system, fuel octane rating (too low) and fuel mixture (too weak). Discard plugs, rectify fault immediately

anti-friction balls are not lost as the baseplate upper and lower sections separate.

8 Mount the shaft collar in a vice then drive out the roll pin and remove the collar and washer.

9 Withdraw the shaft from the distributor body.

10 Extract the felt lubrication pad from the recess in the top of the shaft and remove the screw which is exposed.

11 Mark the relationship of cam assembly to shaft and separate them.

12 If the cam counter weights and springs must be dismantled, make quite sure that the springs are marked with a dab of quick-drying paint so that they can be reconnected in their original positions.

13 With the distributor dismantled, clean and examine all components for wear. If the shaft bushes and other items are worn, it may well be more economical to purchase a new distributor complete.

14 Take the opportunity to carefully examine the cap and rotor for tiny cracks. These can cause conductance paths and prevent starting or be responsible for erratic running. Renew these components if necessary, particularly the rotor if the metal contact is eroded or the carbon brush inside the cap is worn to the specified minimum.

15 Reassembly is a reversal of dismantling, apply light grease to all components as work proceeds and make quite sure that they are aligned with each other in their original positions.

## 8 Ignition timing – adjustment

1 For the engine to run efficiently the spark produced at the spark plugs must occur at precisely the right moment during the engine's combustion cycle. To set ignition timing proceed as follows.

2 Run the engine until it reaches normal operating temperature.

3 Disconnect and blank off the idle compensator vacuum hoses, on the inlet manifold side. Disconnect the electrical connection to the cooling fan switch. (This is to prevent the fan switching on during the adjustment, which would cause a drop in engine speed.)

4 Run the engine at between 2000 and 3000 rev/min for a few moments, under 'no-load' conditions then allow it to idle.

5 Using a tachometer, check idle speed is 900 rev/min or just below. If it is not, then adjust the carburettor throttle adjusting screw. (See Chapter 3.)

6 With the engine idling in this condition check ignition timing using a strobe light. (See Section 9.)

7 If the ignition timing is not as specified, adjust by loosening the clamp nut on the distributor and turning the distributor in its housing. Once the timing is correct, tighten the clamp nut.

8 Remove the blanks from the vacuum hoses and re-connect the hoses, then run the engine at between 2000 and 3000 rev/min for a few moments, then allow it to idle.

9 Adjust the idle speed to that specified by turning the carburettor throttle adjusting screw in or out.

10 Now re-check ignition timing with the strobe light.

## 9 Timing procedures – static and dynamic

1 There are two generally used methods to set ignition timing. The first being set with the engine stationary (static timing) and the second with the engine running (dynamic timing). Static timing should be regarded as a basic setting only. Dynamic timing is far more accurate, but requires the use of a tachometer and a strobe light. These are a worthwhile investment for the home mechanic, and will recoup their cost in fuel savings.

### Static timing procedure

2 Remove the spark plugs, enabling the engine to be turned easily by hand (use a socket wrench on the crankshaft pulley nut) and turn the engine so that No 1 cylinder is just approaching its compression stroke. This can be verified by placing your thumb over the spark plug hole of No 1 cylinder and feeling for the build up of pressure as the engine is turned. Both valves on No 1 cylinder should be closed and the rotor arm in the distributor will be pointing to the HT terminal lead which feeds No 1 spark plug.

3 Continue to turn the engine until the notch in the crankshaft pulley wheel is in line with the specified timing mark on the fixed plate on the lower camshaft drivebelt cover.

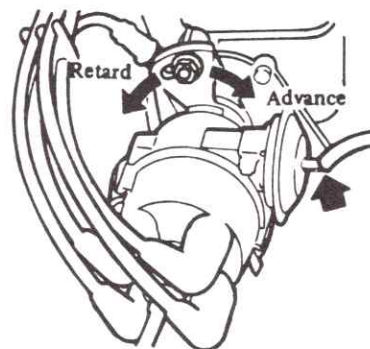


Fig. 4.4 Adjusting ignition timing by turning the distributor in its housing (Sec 8)

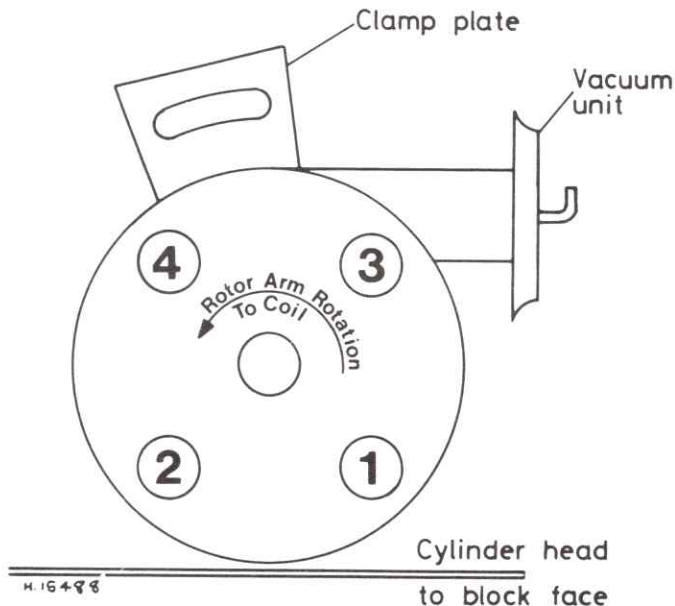


Fig. 4.5 HT lead connections on distributor to spark plugs (Sec 8)

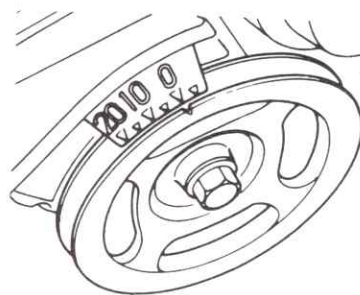


Fig. 4.6 Timing marks on crankcase (Sec 9)

- 4 Connect a 12 volt test lamp between the contact breaker terminal and a good earth.
- 5 Switch on the ignition, slacken off the clamp nut on the distributor, and turn the distributor anti-clockwise until the lamp goes out. Now slowly turn the distributor back until the lamp just lights.
- 6 Tighten the clamp nut and turn the engine through two complete revolutions before re-checking that the timing is set correctly.
- 7 Remove the test lamp, refit the distributor cap, spark plugs and HT leads.

#### *Dynamic timing procedure*

- 8 Connect up a tachometer and strobe light according to the manufacturer's instructions, having first ensured that the distributor dwell angle is correct (Section 4).
- 9 Start the engine, then point the strobe light at the timing mark on the crankshaft pulley.
- 10 As the strobe light flashes on and off, the timing marks will appear to be stationary and can be easily read.
- 11 Adjust the timing by turning the distributor body in its housing, as previously described, until the desired timing value is obtained. Remember to blank off vacuum hoses as described and check engine speed is correct for the operation undertaken.
- 12 Remove the strobe light and tachometer, check the clamp nut on the distributor has been fully tightened, and reconnect any vacuum hoses disconnected.

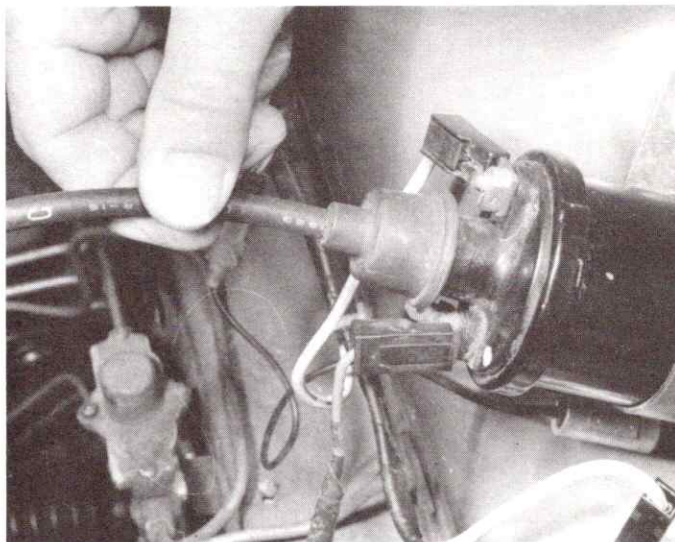
### 10 Spark plugs, HT leads and distributor cap – general

- 1 To maintain engine efficiency and economy the spark plugs must be kept in good condition.
- 2 At the intervals specified in Routine Maintenance the plugs should be removed, cleaned and the gap re-set.
- 3 To remove the plugs, remove the air cleaner, pull off the HT leads from the spark plugs. (Do this only by gripping the rubber cover, not the lead itself, or damage to the lead may result.)
- 4 Clean the area around the spark plug recesses with a brush to remove dirt which may fall into the cylinder when the plugs are removed.
- 5 Remove each spark plug using a double depth socket or box spanner.
- 6 Examination of the spark plugs can provide a good indication of engine condition.
- 7 If the nose of the plugs is clean and white, with little or no deposits, it indicates the fuel/air mixture is too weak.
- 8 If the nose of the plug is covered with a hard black deposit, then it shows the mixture is too rich.
- 9 If the deposit is black, wet and oily, it may indicate that internal wear of the engine has occurred to the degree where oil is passing the pistons and being burned in the combustion chambers. Do not confuse this condition with that of an engine 'flooded' with petrol, where excessive use of throttle and choke has resulted in the plugs being soaked in petrol, with a resultant failure to start.
- 10 The ideal condition for the plugs to be in is that of an even light brown to greyish brown deposit, indicating the mixture is correct.
- 11 Long tapering brown discolouration of the white ceramic insulation of the plug indicates a break down internally of the plug, and it should be renewed.
- 12 Wash the plugs in solvent to remove any oily deposits before cleaning.
- 13 Plugs may be cleaned using a wire brush, but it is better to use one of the abrasive cleaning machines specially designed for the job, or your local garage will do this for you.
- 14 The size of the spark plug gap is vitally important to engine efficiency, and must be set correctly. To do this, measure the gap with feeler gauges, then bend the outer electrode either in or out until the gap is correct. Never try to bend the centre electrode or damage to the insulation will occur. Special tools for gap setting are available commercially at little expense, and are worth having.
- 15 Lightly grease the plug threads using graphite or high melting point grease, then screw each plug in by hand, ensuring the plugs are not cross-threaded.
- 16 Tighten to the correct torque, using a torque wrench, to avoid danger of stripping the threads in the aluminium cylinder head.

- 17 Refit the HT leads, in their correct firing order 1 – 3 – 4 – 2, No 1 cylinder being at the timing belt end of the engine.
- 18 HT leads require little or no attention except to check their general condition and that they are making good electrical contact with the plugs and where they connect to the distributor cap.
- 19 Whenever the distributor cap is removed, take the opportunity of wiping the inside clean, and checking the inner terminals are not fouled up. A hard shellac type deposit often forms on them, and may be removed using a file or sharp instrument.
- 20 Check also the spring-loaded carbon conductor in the centre of the cap for minimum protrusion.
- 21 Thin lines running between electrodes in the cap are an indication of 'electrical tracking' and the cap should be removed and a new one fitted in its place.

### 11 Coil – description and testing

- 1 The coil is located to the left-hand side of the engine compartment (photo).



11.1 Electrical connections to the coil

- 2 To ensure correct HT polarity at the spark plugs, the LT coil leads must always be connected correctly. These are usually marked positive and negative (+ or –) and reference should be made to the wiring diagrams at the end of this manual for correct colour coding.
- 3 The coil may be tested using an ohmmeter, connected across the two LT terminals on the coil to check the primary winding resistance, and across the negative LT terminal and central HT terminal to check the secondary winding resistance. If the resistance figures obtained fall outside that given in the Specifications, the coil should be renewed.
- 4 A ballast resistor is mounted next to the coil, and its purpose is to supply battery voltage to the coil during starting. Under normal running conditions the coil operates on a reduced voltage.

### 12 Fault diagnosis – ignition system

- 1 If the engine suddenly fails to start after a period of normal operation, first check that there is fuel in the tank. If the engine turns over normally on the starter motor and the battery is evidently well charged, check the HT circuit.
- 2 Wet or damp components is a common fault in non-starting trouble, and the use of a water repellent spray is highly recommended, especially if the vehicle is habitually left outside. If dampness is

suspected then wipe all components dry, especially the inside of the distributor cap.

3 If the engine still fails to start, disconnect an HT lead from one of the spark plugs and holding the lead with well insulated pliers so that it is almost touching the cylinder block, have someone operate the starter. A regular blue spark should occur. If it does then the spark plugs themselves should be suspected of malfunction.

4 If no spark occurs, disconnect the main feed HT lead from the

distributor cap and again check for a spark, as in paragraph 3. If there is a spark check the distributor cap rotor arm and HT leads.

5 To test the ignition switch supply, connect a voltmeter or test lamp between the LT wire on the battery side of the coil and earth, and with ignition switched on and the points open. No reading indicates a break in supply from the ignition switch.

6 Test between the LT terminal on the distributor side of the coil and earth. If there is no reading, this indicates a faulty coil or condenser.

# Chapter 5 Clutch

## Contents

Clutch – adjustment .....	3	Clutch release bearing, operating fork arm and cross-shaft –	
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Clutch – refitting .....	9	Fault diagnosis – clutch .....	10
Clutch – removal .....	6	General description .....	1
Clutch cable – renewal .....	4	Routine maintenance .....	2
Clutch pedal – removal and refitting .....	5		

## Specifications

Type .....	Cable operated, single dry plate with diaphragm spring and pressure plate	
<b>Driven plate</b>		
Diameter .....	160 mm (6.30 in)	
Maximum wear limit (lining surface to rivet) .....	0.3 mm (0.012 in)	
Maximum run-out .....	0.5 mm (0.020 in)	
Hub spline play .....	0.6 mm (0.024 in)	
<b>Clutch cover</b>		
Diaphragm spring finger maximum variation .....	0.5 mm (0.020 in)	
<b>Clutch pedal</b>		
Pedal height (dimension H) .....	203 to 213 mm (7.99 to 8.39 in)	
Free play (dimension A) .....	18 to 28 mm (0.71 to 1.10 in)	
Release lever free play .....	2 to 4 mm (0.08 to 0.16 in)	
<b>Note:</b> See text for explanation of dimensions		
<b>Torque wrench settings</b>		
Pedal stop bolt locknut .....	<b>lbf ft</b>	<b>kgf m</b>
Cable adjustment locknut .....	9 to 11	1.2 to 1.5
Pressure plate bolts .....	2.2 to 2.9	0.3 to 0.4
Clutch cable securing bracket bolt .....	12 to 15	1.6 to 2.1
	6.7 to 8.7	0.93 to 1.2

### 1 General description

The clutch is of single dry plate type operated by cable from a pendant pedal. When the pedal is depressed, the cable pulls the release lever which forces the ball bearing type release bearing against the diaphragm spring fingers of the cover assembly. This releases the pressure plate from the linings of the driven plate, so disengaging the drive between the engine and transmission.

When the pedal is released, the pressure plate is forced against the driven plate which in turn is forced against the flywheel. Drive is then restored from the engine, through the driven plate and into the transmission via the input shaft.

### 2 Routine maintenance

Every 6000 miles (10 000 km) check the clutch pedal height and cable free play, adjusting if necessary. Check the pedal for smooth operation and lightly oil the pivot bushes with clean engine oil.

### 3 Clutch – adjustment

1 Remove the carpeting from the area immediately below the clutch pedal, and using a ruler measure the distance from the top surface of the clutch pedal to the floor, as shown in Fig. 5.2.

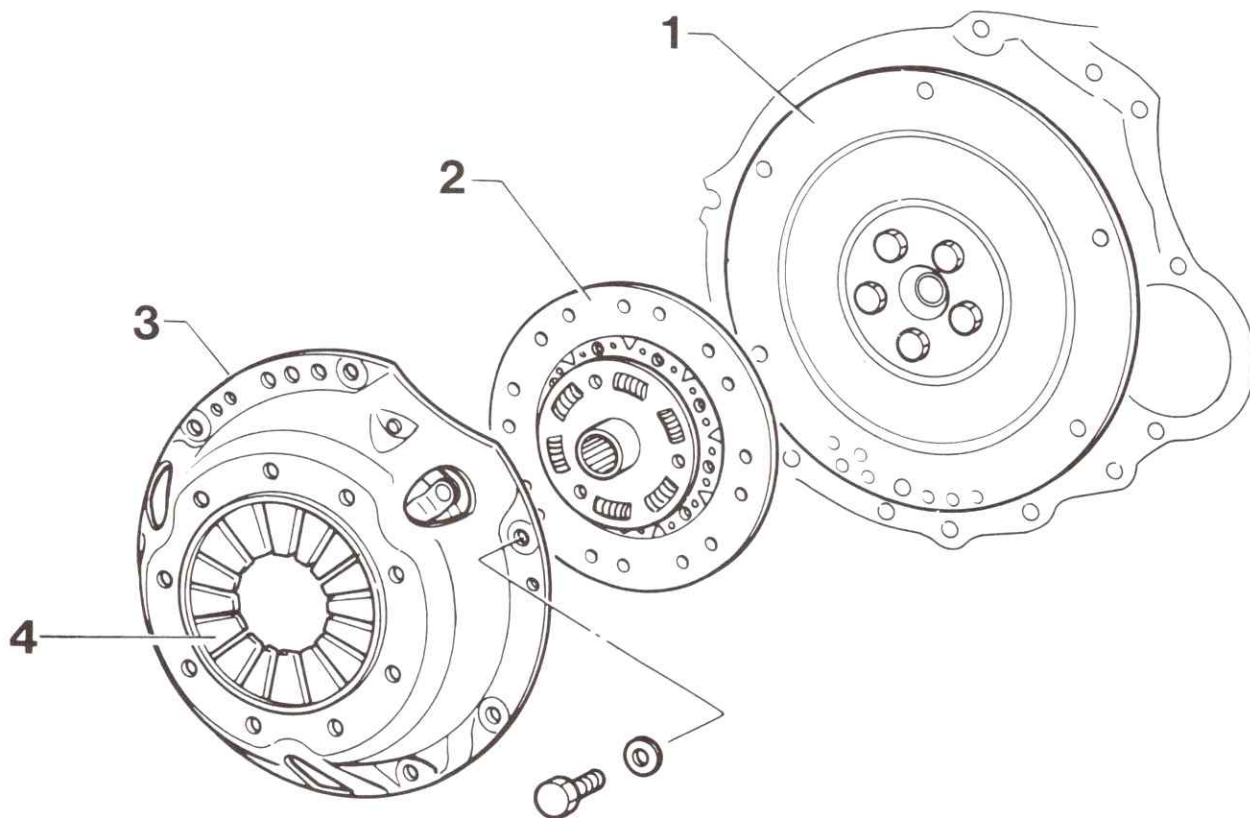


Fig. 5.1 Clutch components (Sec 1)

1 Flywheel

2 Driven plate

3 Pressure plate

4 Diaphragm and spring fingers

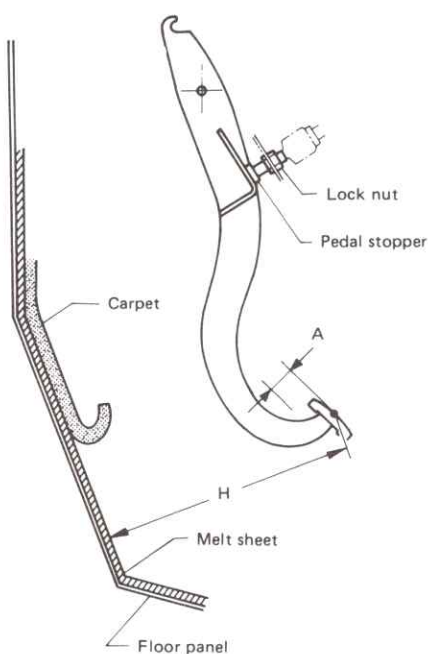


Fig. 5.2 Clutch pedal adjustment (Sec 3)

$A = 0.71 \text{ to } 1.10 \text{ in (18 to 28 mm)}$   
 $H = 7.99 \text{ to } 8.39 \text{ in (203 to 213 mm)}$

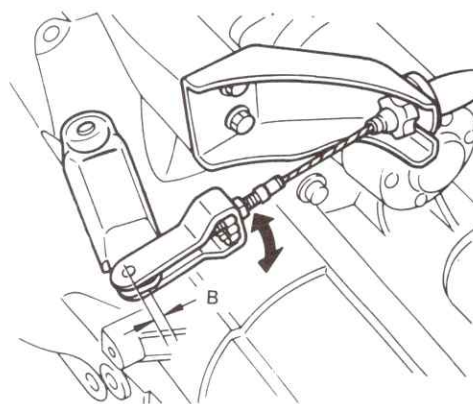


Fig. 5.3 Release lever free play adjustment (Sec 3)

$B = 0.08 \text{ to } 0.16 \text{ in (2 to 4 mm)}$

- 2 If the figure obtained is not as laid down in the Specifications then make adjustment on the pedal stop bolt until it is within limits.
- 3 Now check the free play at the clutch release lever arm in the engine compartment, adjusting as necessary using the knurled adjusting nut.
- 4 Fully depress the clutch pedal several times and recheck the dimensions.
- 5 Finally check the clutch pedal free play, then check all locknuts are fully tightened.

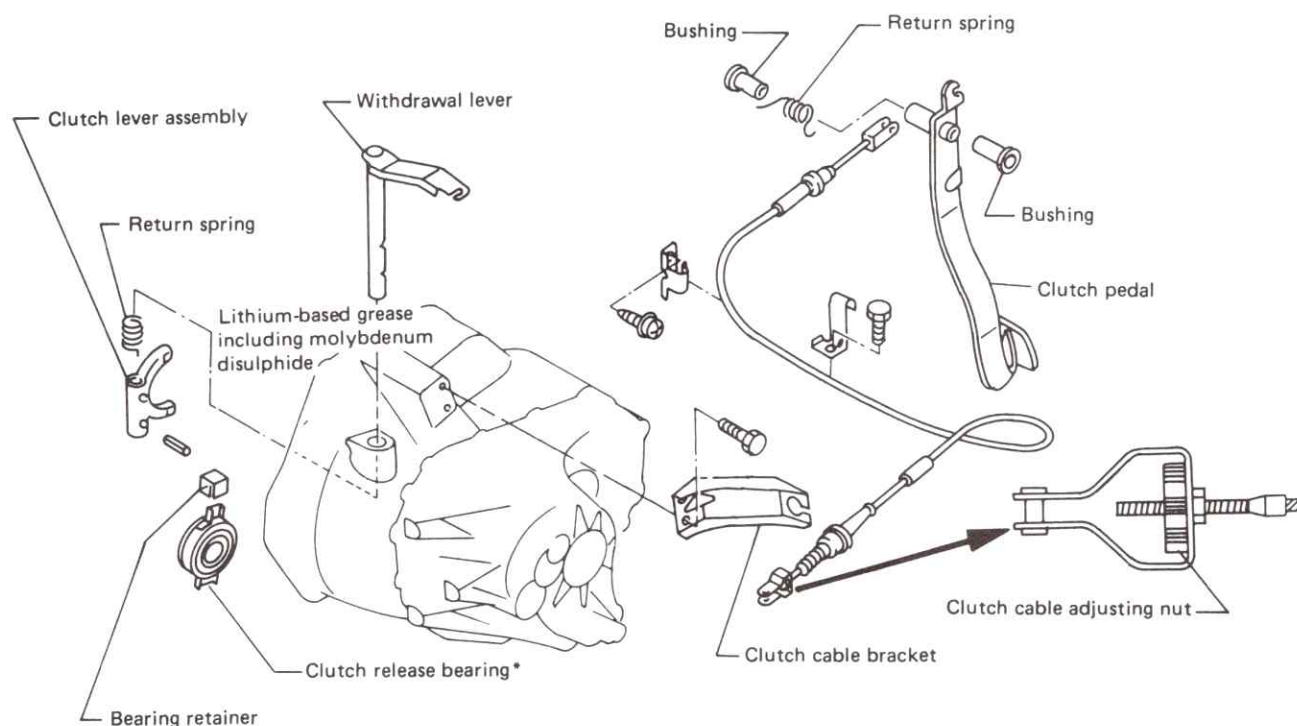
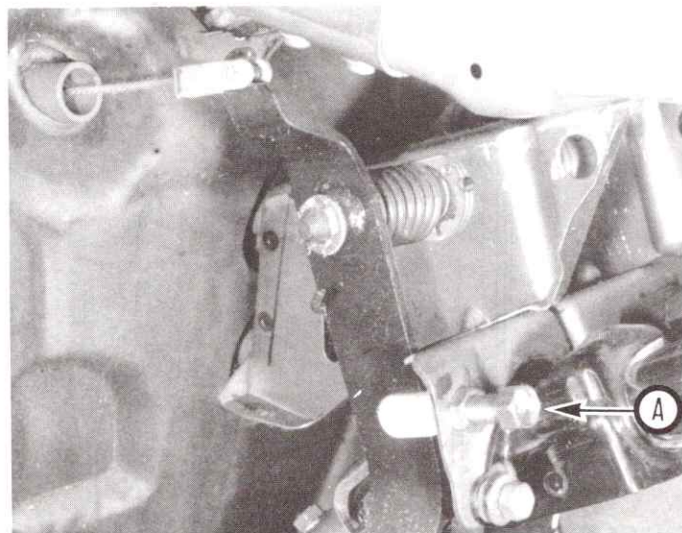


Fig. 5.4 Clutch cable components (Sec 4)

**Note:** Sometimes cables may stretch with age, and the tolerances laid down in the Specifications will not be met because the cable is too long. A new cable is the only answer.

#### 4 Clutch cable – renewal

1 Loosen the locknut on the knurled adjuster on the clutch release lever arm in the engine compartment and loosen the adjuster sufficiently for the cable end assembly to be disconnected from the release arm lever and the clutch cable bracket (photo).



4.1 Clutch pedal adjusting bolt A

2 From inside the vehicle, unhook the cable end assembly from the top of the clutch pedal.

3 Unscrew the two bolts holding the grommet panel where the cable passes through the bulkhead, and feeding the cable through the bulkhead, remove it from the vehicle.

4 The fitting of a new cable is a reversal of the removal operations, and then adjusting the cable as described in Section 3.

#### 5 Clutch pedal – removal and refitting

1 Disconnect the cable end from the top end of the pedal.

2 Extract the E-clip from the end of the pedal pivot shaft.

3 Unhook the pedal return spring and slide the pedal off the pivot shaft.

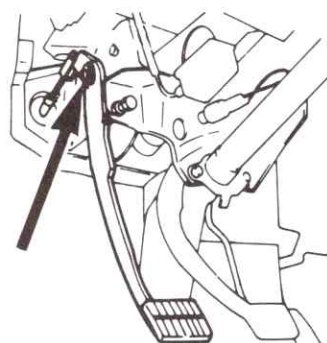


Fig. 5.5 Clutch pedal E-clip location (Sec 5)

- 4 Inspect the pivot bushes for wear and renew if necessary.
- 5 Refitting is a reversal of removing, but apply grease to all pivot points and bushes. Finally adjust the pedal and clutch cable as described in Section 3.

## 6 Clutch – removal

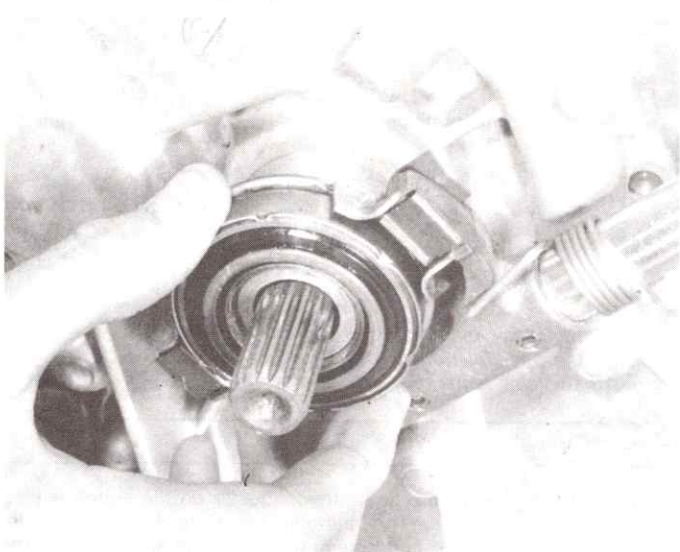
- 1 To gain access to the clutch, the transmission must be removed as described in Chapter 6.
- 2 Unscrew the clutch pressure plate bolts progressively a turn at a time until the pressure being exerted by the diaphragm spring is relieved. (This prevents danger of warping to the diaphragm and cover.) It may be necessary to jam the flywheel to prevent it turning while unscrewing the bolts.
- 3 Remove the pressure plate, catching the driven plate as it is released from the flywheel.
- 4 The bolts are offset, so it can only be replaced in one position.

## 7 Clutch – inspection

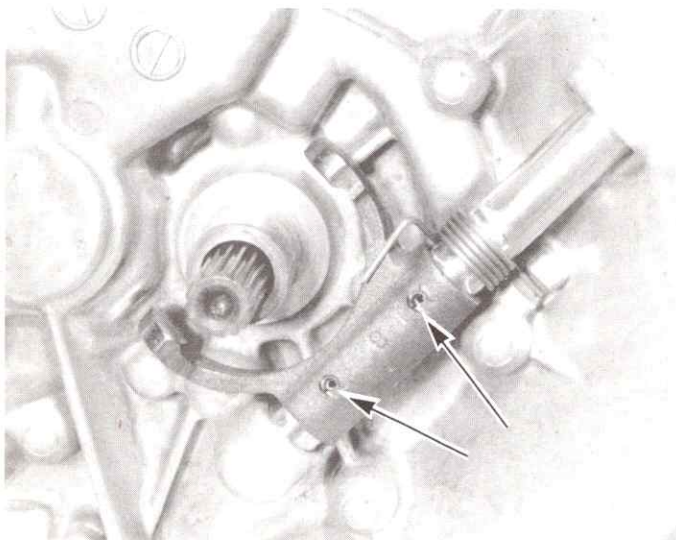
- 1 Examine the driven plate. If the linings are worn down to the limit given in the Specifications, or is close to it, then renew the plate.
- 2 Examine the linings also for burnt or discoloured patches, and contamination from oil or grease, which will all impair the efficiency of the clutch.
- 3 Check the amount of backlash between the driven plate and splines of the input shaft. Also check the driven plate for run-out. Inspect the torsion springs for damage, wear and cracks.
- 4 Check the pressure plate assembly for general wear, cracks or severe corrosion, and the fingers of the diaphragm for wear, especially where they come into contact with the release bearing. Renew as necessary. (A complete new assembly will have to be obtained, as the diaphragm cannot be dismantled further.)
- 5 Inspect the friction surfaces of both the pressure plate and the flywheel, for grooves, cracking or pitting. The flywheel may be smoothed with fine emery cloth if it is slightly rough, but anything more serious requires renewal. The pressure plate will have to be renewed if it shows any signs of wear.
- 6 If contamination by oil is evident on clutch removal, then inspect the crankshaft rear oil seal for leaking, and renew it before replacing the clutch (refer to Chapter 1).

## 8 Clutch release bearing, operating fork arm and cross-shaft – removal, inspection and refitting

- 1 Whenever the transmission is dismantled for clutch renewal, the release bearing should also be renewed, and the fork arm and cross-shaft inspected.
- 2 Remove the release bearing from the fork arm by releasing the spring clips which hold it, and slide it off its mounting sleeve on the bellhousing (photo).
- 3 Inspect the fork arm for cracks and wear, and the return spring for tension.
- 4 The fork arm may be removed from the cross-shaft by punching out the two roll pins which hold it in place on the cross-shaft. To do this the roll pins must be in line with the cavity in the bellhousing as they are punched out (photo).
- 5 Inspect the shaft for wear especially in the area where it sits in the bearing of the bellhousing.
- 6 Reassembly is a reversal of this procedure, but grease all moving, mating surfaces with a lithium based grease, and always use new roll pins on the fork arm.
- 7 Before replacing the release bearing, apply a lithium based grease in the areas shown in Fig. 5.6.
- 8 Push the release bearing fully home over the mounting shaft and onto the fork ends, and ensure the spring clips engage by listening for an audible click as they snap home.



8.2 Clutch release bearing



8.4 Release fork arm retaining roll pins

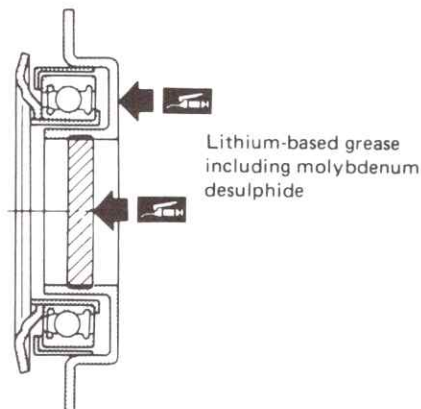


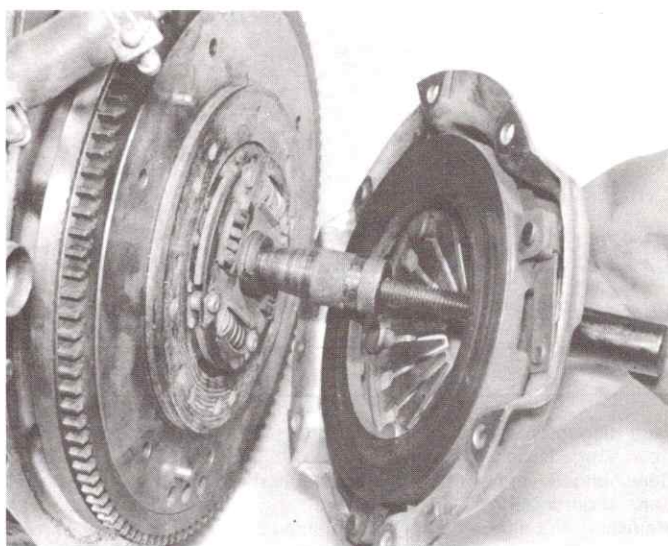
Fig. 5.6 Area to apply grease on clutch release bearing (Sec 8)

## 9 Clutch – refitting

- 1 Ensure the flywheel and pressure plate are free from protective coatings, and clean off any oil or grease.
- 2 Position the driven plate against the flywheel so that the side with the greater hub projection faces away from the flywheel.
- 3 Offer up the pressure plate, and screw in the retaining bolts finger tight. Note that the locating dowels are offset to prevent incorrect fitment.
- 4 To allow the input shaft to enter the clutch when the transmission is replaced, the driven plate must be centralised before tightening the retaining bolts.
- 5 If a special clutch aligning tool is not available, then a broom handle, suitable size socket or similar item should be used (photo).
- 6 Move the tool within the aperture to locate the driven plate centrally. This can be judged by viewing the driven plate hub in relation to the hole in the centre of the diaphragm spring. When the hub appears exactly in the centre of the hole, all is correct.
- 7 Once the driven plate is centralised the pressure plate bolts may be tightened. Do this progressively, a turn or two at a time to the specified torque. Remove the centralising tool.

**Note:** *Difficulty in refitting the transmission will indicate the driven plate has not been properly centralised, and this procedure will need to be repeated until the input shaft slides home without trouble.*

- 8 Refit the transmission with reference to Chapter 6.



9.5 Clutch alignment tool

## 10 Fault diagnosis – clutch

Symptom	Reason(s)
Judder when taking up drive	Loose engine or gearbox mountings Badly worn friction linings or contaminated with oil Worn splines on gearbox input shaft or driven plate hub
Clutch drag (or failure to disengage) so that gears cannot be meshed	Incorrect adjustment Rust on splines (may occur after vehicle standing idle for long periods) Damaged or misaligned pressure plate assembly Cable stretched or broken
Clutch slip (increase in engine speed does not result in increase in car speed – especially on hills)	Incorrect adjustment Friction linings worn out or oil contaminated
Noise from clutch	Worn release bearing Worn or loose components of pressure plate or driven plate

# Chapter 6 Manual transmission

For modifications, and information applicable to later models, see Supplement at end of manual

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Mainshaft and differential bearing preload adjustment .....	9	Transmission components – inspection .....	7

## Specifications

Type .....	Transverse, four- or five-speed with reverse. Synchromesh on all forward gears, floor mounted gearchange
------------	--

### Designation

Four-speed .....	RN4F40A
Five-speed .....	RS5F41A

### Ratios

1st .....	3.412 : 1
2nd .....	1.958 : 1
3rd .....	1.258 : 1
4th .....	0.921 : 1
5th (if fitted) .....	0.721 : 1
Reverse .....	3.385 : 1
Final drive ratio .....	3.810 : 1 (4-speed) or 3.591 : 1

### Lubrication

Oil capacity:	
Four-speed .....	4.4 pints (2.5 litres)
Five-speed .....	4.5 pints (2.6 litres)
Oil type/specification .....	Gear oil, viscosity SAE 80 to API GL4 (Duckhams Hypoid 80)

### Gearbox setting tolerances

Gear endfloat:	
1st gear .....	0.22 to 0.44 mm (0.0087 to 0.0173 in)
2nd gear .....	0.22 to 0.54 mm (0.0087 to 0.0213 in)
3rd gear .....	0.22 to 0.49 mm (0.0087 to 0.0193 in)
4th gear .....	0.22 to 0.39 mm (0.0087 to 0.0154 in)
5th gear .....	0.22 to 0.29 mm (0.0087 to 0.0114 in)
Side gear-to-pinion mate gear clearance .....	0 to 0.3 mm (0 to 0.012 in)
Available side gear thrust washers .....	0.77 mm (0.0303 in)
	0.82 mm (0.0323 in)
	0.87 mm (0.0343 in)
Baulk ring-to-1st gear clearance:	
Standard .....	1.0 to 1.35 mm (0.0394 to 0.0531 in)
Wear limit .....	0.7 mm (0.028 in)
Mainshaft groove clearance (after fitment of snap-ring) .....	0 to 0.15 mm (0 to 0.0059 in)
Available mainshaft snap-rings .....	2.0 mm (0.079 in)
	2.1 mm (0.083 in)
Input shaft groove clearance (after fitment of snap-ring) .....	0 to 0.13 mm (0 to 0.0051 in)
Available input shaft snap-rings .....	1.65 mm (0.650 in)
	1.75 mm (0.0689 in)
	1.85 mm (0.0728 in)
Reverse check plunger lengths:	
Distance X (see text):	
Less than 17.78 mm (0.7000 in) .....	
17.78 to 18.18 mm (0.7000 to 0.7157 in) .....	
18.18 to 18.58 mm (0.7157 to 0.7315 in) .....	
More than 18.58 mm (0.7315 in) .....	
Plunger length Y	
17.17 mm (0.6760 in)	
17.57 mm (0.6917 in)	
17.97 mm (0.7075 in)	
18.58 mm (0.7315 in)	

## Turning torque (new bearings):

Final drive only .....	8.7 to 26.0 lbf in (10 to 30 kgf cm)
Total assembly .....	22.0 to 52.0 lbf in (25 to 60 kgf cm)

**Torque wrench settings**

	lbf ft	kgf m
Clutch housing to transmission case .....	12 to 15	1.6 to 2.1
5th and reverse gear check plug .....	14 to 22	2.0 to 3.0
5th and reverse check ball plug .....	12 to 15	1.6 to 2.1
Shift check ball plug .....	6.5 to 8.7	0.9 to 1.2
Shift rod plate to clutch housing .....	4.3 to 5.8	0.6 to 0.8
Guide plate to clutch housing .....	4.3 to 5.8	0.6 to 0.8
Reverse bracket assembly to clutch housing .....	4.3 to 5.8	0.6 to 0.8
Reverse light switch to transmission case .....	1.6 to 2.9	0.25 to 0.4
Bearing retainer to clutch housing .....	12 to 15	1.6 to 2.1
Drain plug .....	7 to 14	1.0 to 2.0
Final gear to differential case .....	54 to 65	7.5 to 9.0
Support rod to gearbox .....	21 to 27	2.9 to 3.7
Control rod to gearbox .....	4.3 to 5.8	0.6 to 0.8
Selector stopper bolt .....	2.9 to 3.6	0.4 to 0.5
Rubber holder to body .....	2.2 to 2.9	0.3 to 0.4
Rubber holder nut .....	2.2 to 2.9	0.3 to 0.4
Speedometer pinion gear .....	2.2 to 2.9	0.3 to 0.4

**1 General description**

Both the four-speed and five-speed gearboxes are a new lightweight unit designed exclusively for use with a transverse engine. They are identical to each other, the five-speed simply having the extra gear added.

Synchromesh is provided on all forward gears, and the gear lever is of the conventional, floor mounted type.

The transmission unit, which includes the differential unit, is mounted transversely, in line with the engine. Power is transmitted from the clutch via an input shaft and mainshaft to the final drive/differential unit, and on to the front roadwheels via the driveshaft.

The overhaul procedure given here describes a five-speed gearbox, those owners working on a four-speed box should ignore references to the 5th gear.

**2 Routine maintenance**

1 Every 6000 miles (10 000 km) or 6 months, whichever comes first, check the oil level in the gearbox and top up as necessary. Remove the bolt holding the speedometer drive cable in place (photo) and remove the speedometer drivegear (photo). This acts as a dipstick, as shown in Fig. 6.1 and filler hole. Replace the speedometer drive and securing bolt on completion.

2 When operating under severe or dusty conditions renew the transmission oil every 24 000 miles (40 000 km) or 2 years, whichever comes first. The drain plug is situated on the underside of the transmission casing (photo).

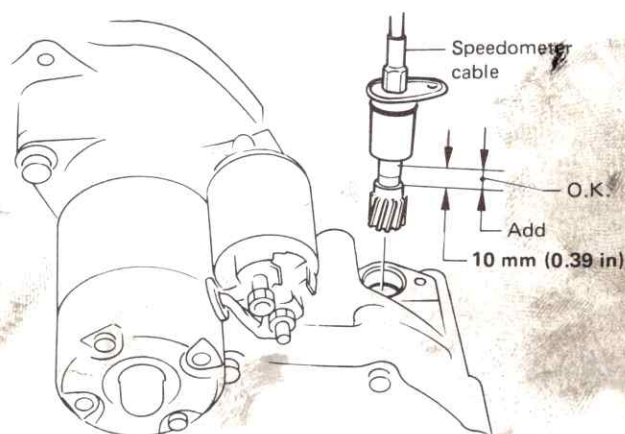
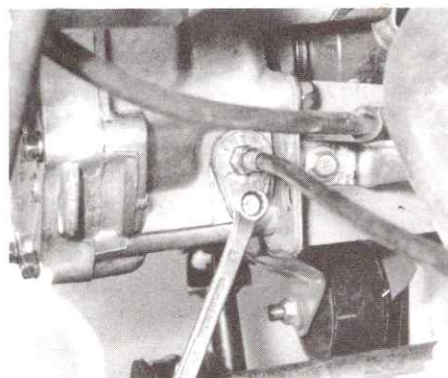
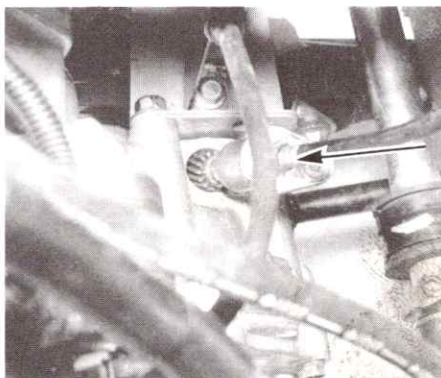


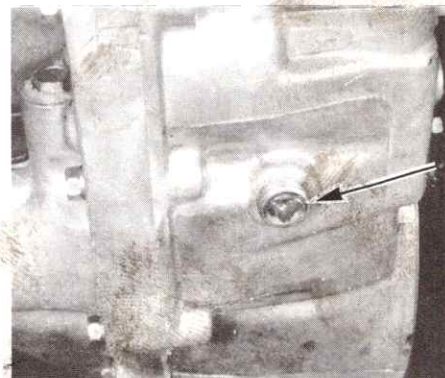
Fig. 6.1 Checking the gearbox oil level (Sec 2)



2.1A Removing the speedometer drive securing bolt



2.1B Withdrawing the speedometer drive unit



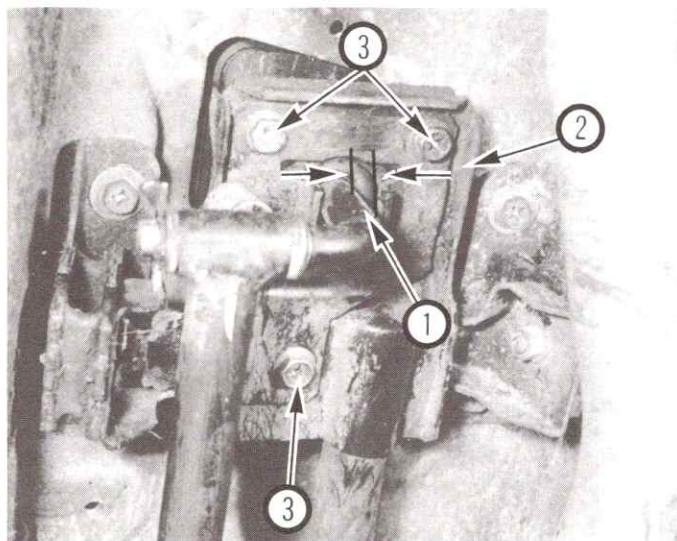
2.2 Gearbox oil drain plug

### 3 Gearchange lever – adjustment

- 1 Twist off the gearchange lever knob. It may be necessary to protect the knob with rags and use a wrench.
- 2 Remove the rubber boot then refer to Chapter 12 for removal of the clock and its plastic housing.
- 3 Select first gear and check that there is a 0.039 in (1.0 mm) clearance between the lever and the stopper plate. If the clearance is incorrect loosen the three securing bolts and move the plate to obtain the correct clearance (photo). Tighten the bolts and check the selection of all gears.
- 4 Refit the clock and its housing and the rubber boot, before refitting the gear lever knob.

### 4 Gearchange lever control rod – removal and refitting

- 1 Remove the gear lever knob, clock and housing as described in the previous Section.
- 2 Undo and remove the three screws holding the dust cover and remove it from the gear lever (photos).
- 3 Remove the bolt from the front end of the support rod (photo).
- 4 Then remove the locking spring pin from the control rod end, and slide the control rod off the gear lever, noting the order of all washers and bushes (photo).



3.3 Adjustment point between gear lever and stopper plate  
 1 Adjustment point      3 Securing bolts  
 2 Stopper plate

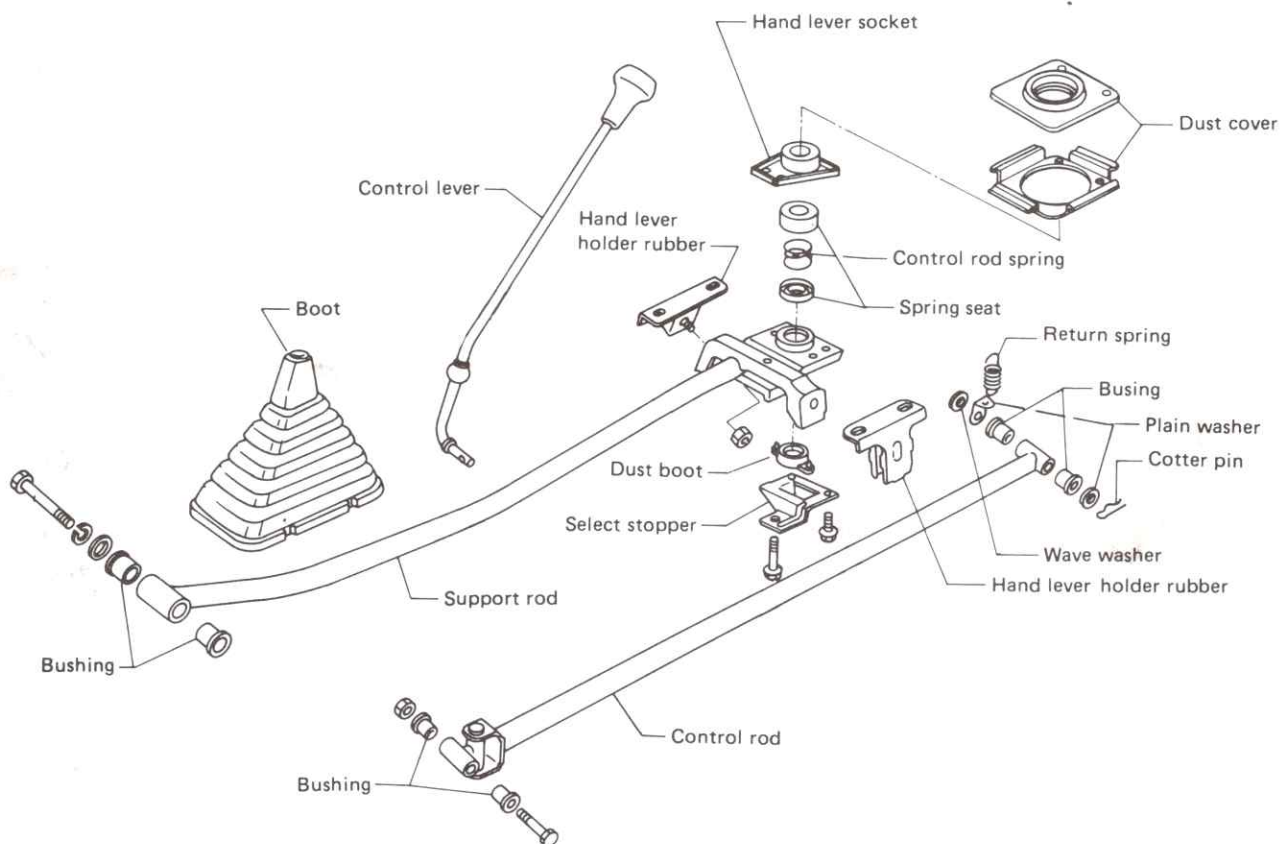
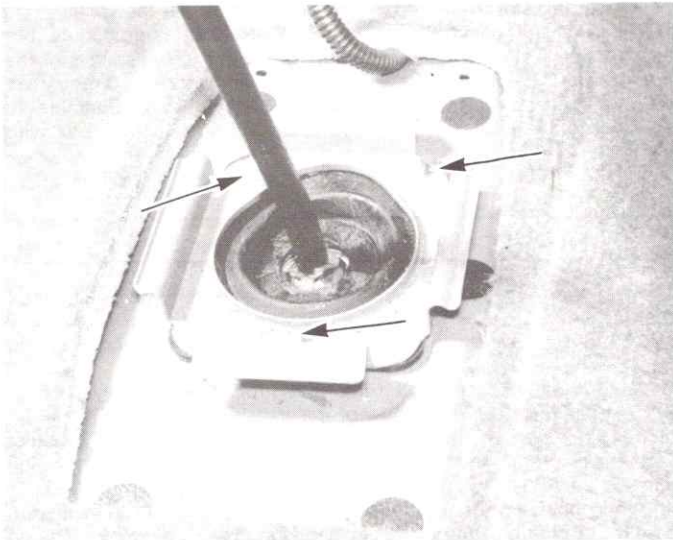
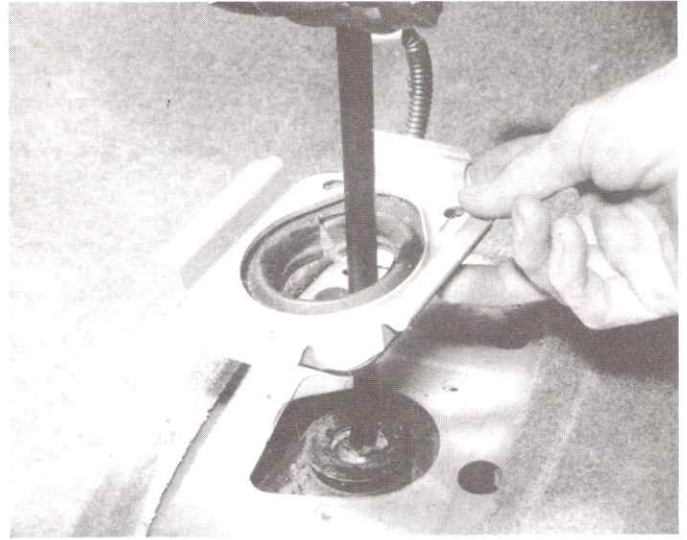


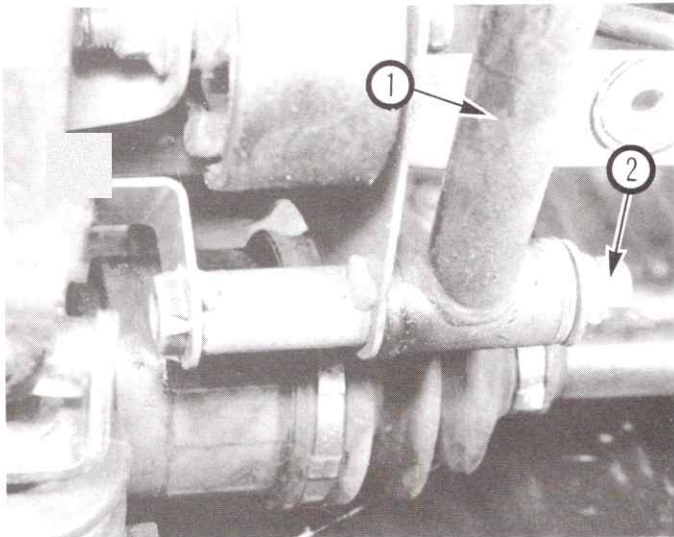
Fig. 6.2 Exploded view of gear lever, control rod and support tube (Sec 3)



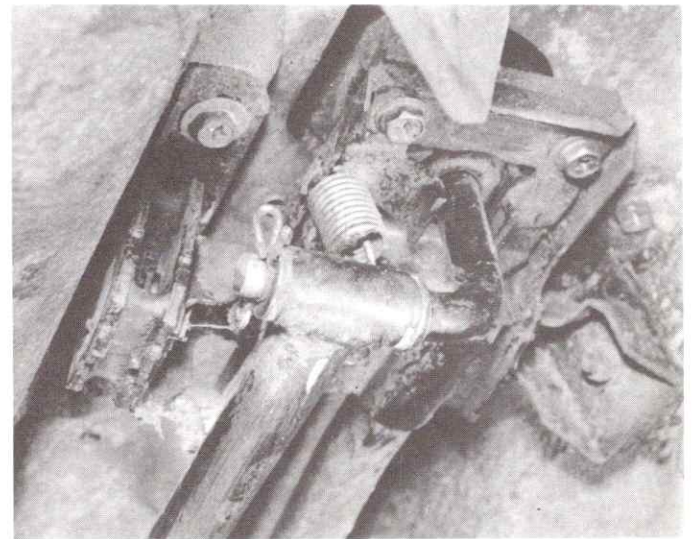
4.2A Gearlever dust cover and securing screws



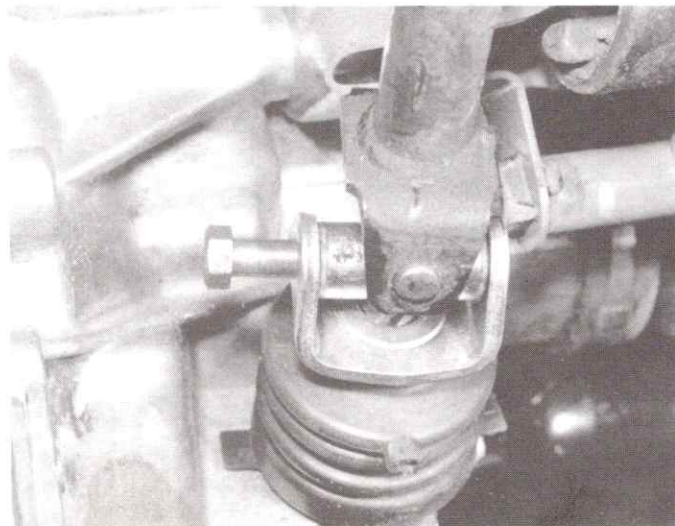
4.2B Removing the dust cover



4.3 Support rod securing bolt  
 1 Support rod 2 Securing bolt



4.4 Control rod-to-gear lever connection



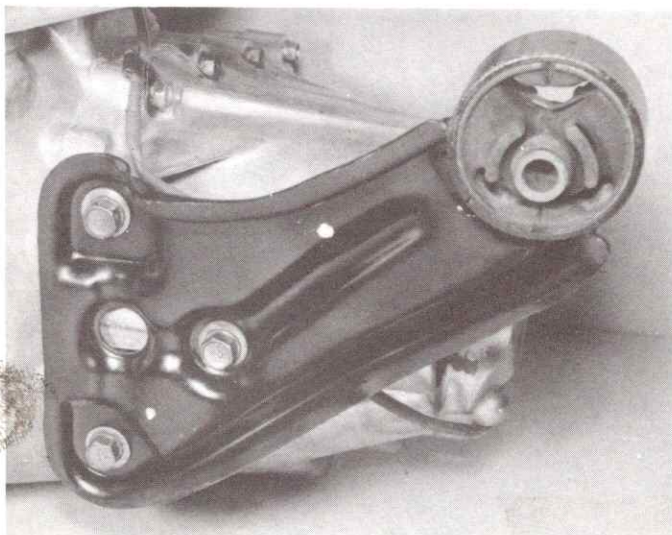
4.5 Removing control lever-to-selector shaft bolt

- 5 Remove the bolt securing the control lever to the gearbox selector shaft (photo).
- 6 Now remove the bolts holding the support rod rear plate position.
- 7 The whole assembly may now be manoeuvred from the vehicle, and the gear lever seating further dismantled as required.
- 8 Reassembly is a reverse of the above process, greasing all moving parts and finally adjusting the control lever stop plate as described in Section 3.

## 5 Transmission – removal and refitting

- 1 The transmission unit is removed complete with the clutch bellhousing. The driveshafts are disconnected at their inboard ends, where they enter the differential unit.
- 2 It will be helpful to refer to Chapter 8 regarding the driveshafts at this point, remembering that the intention is to disconnect the driveshafts from the transmission and not remove them completely.
- 3 Jack the vehicle at the front end jacking points and support it on suitable stands. The engine should also be supported under the oil sump with suitable blocks. Drain the transmission oil.
- 4 Remove the front roadwheels.
- 5 Undo and remove the steering rod balljoints (refer to Chapter 10).

- 6 Undo and remove the two bolts securing the wheel hub knuckle to the lower end of the suspension strut.
- 7 Lower each hub sufficiently to allow the inboard ends of each driveshaft to be levered from the transmission housing.
- 8 Support the driveshafts, hubs and steering rods with wire or string so that they are out of the way and will not be damaged.
- 9 Once the driveshafts are removed, the side gears need to be retained in place to prevent them falling into the differential housing. We used short, tapered lengths of broom handle (see photo 6.4A) gently tapped into the space left by the driveshaft.
- 10 Disconnect the front ends of the gear lever control and support rods (see Section 4).
- 11 Disconnect the clutch operating cable from the release lever (Chapter 5).
- 12 Disconnect the speedometer cable drive unit from the transmission casing (Section 2).
- 13 Disconnect the electrical leads from the reversing light switch.
- 14 Remove the starter motor.
- 15 Ensure the engine is suitably supported under the oil sump with blocks before removing the rear engine mounting bracket, and the front right-hand mounting. Also remove the two support tubes between the oil sump and transmission casing (photos).
- 16 Supporting the transmission unit, remove the five bolts securing it to the engine, noting their lengths and any brackets or clips which may fit under their heads, so that all will be in place on reinstallation.

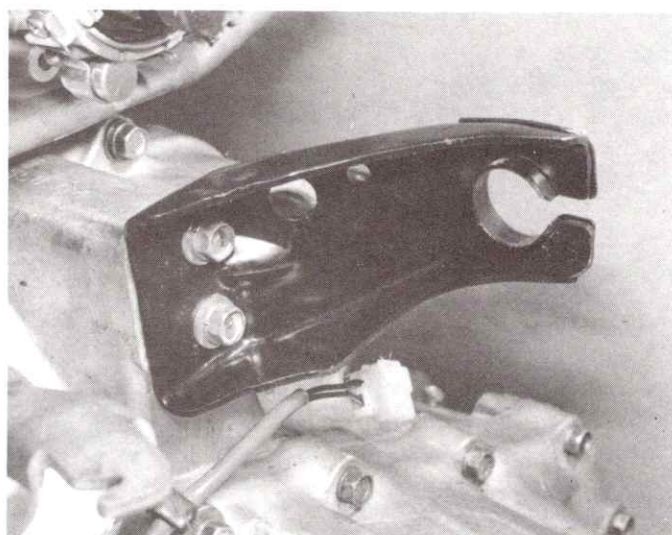


5.15A Engine mounting bracket

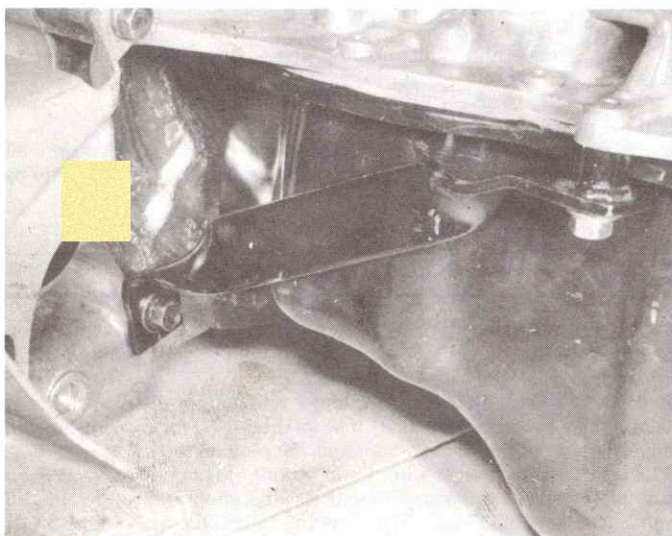
- 17 Lower the unit to the ground and out from under the vehicle.
- 18 Refitting the transmission unit is a reversal of this procedure, but apply a smear of molybdenum disulphide grease to the splines of the input shaft. Tighten all bolts to their specified torque, and reconnect the driveshafts and steering rods, referring to the relevant Chapters.
- 19 Check clutch adjustment (Chapter 5) and refill the gearbox with oil.

## 6 Transmission – dismantling

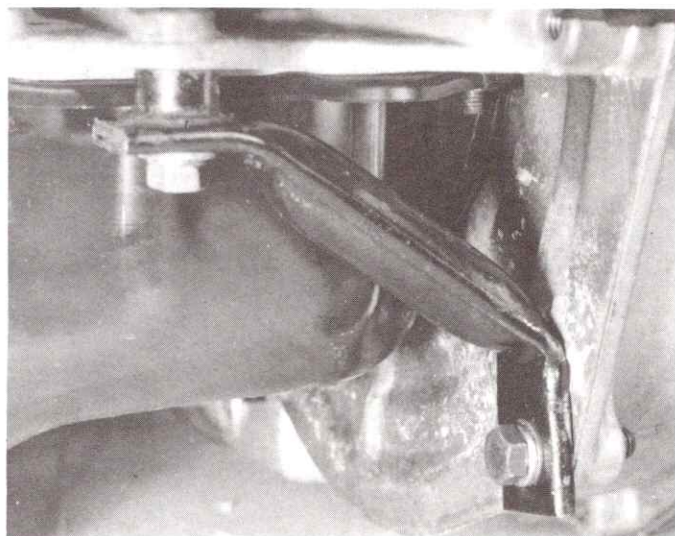
- 1 With the transmission removed from the vehicle, give the unit a thorough wash down to remove any dirt and grime. Remove any mounting brackets left in position if these were not removed during transmission removal, noting their positions.
- 2 Drain the transmission oil if this was not done previously.
- 3 Before separating the halves of the transmission unit, remove the reverse light switch (photo) and the three check ball plugs, together with their springs and steel balls, retaining each and noting which comes from where (photos).
- 4 Undo and remove the twelve bolts which hold the transmission case to the clutch bellhousing, and separate the two by gently tapping with a soft mallet. Do not prise the halves apart, as the soft aluminium faces are easily damaged (photos).



5.15B Engine mounting bracket



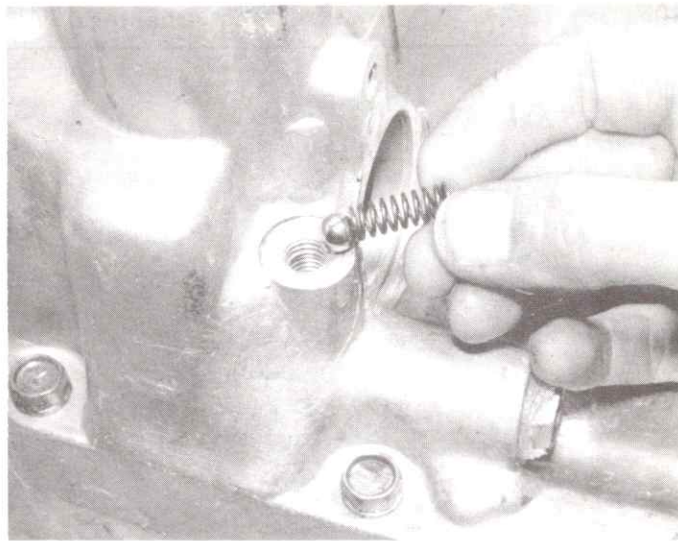
5.15C Engine support stay



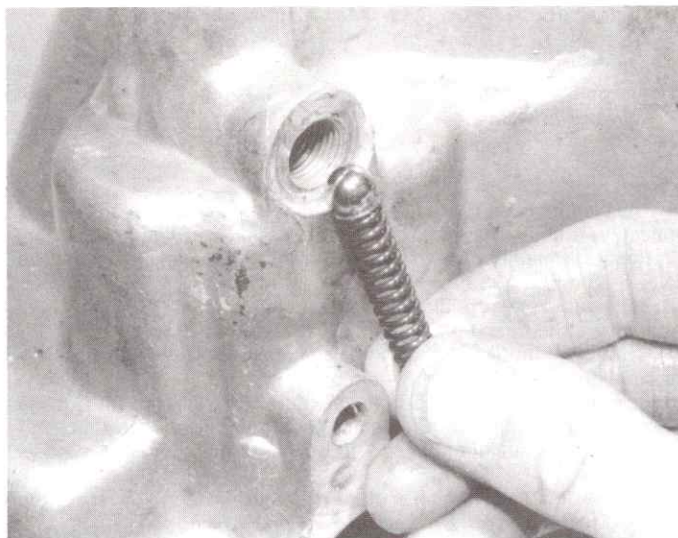
5.15D Engine support stay



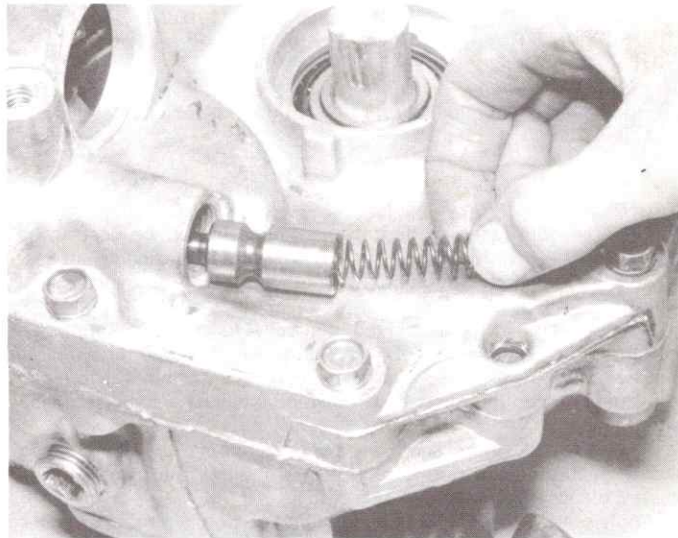
6.3A Removing the reverse light switch



6.3B Removing 5th and reverse check plug



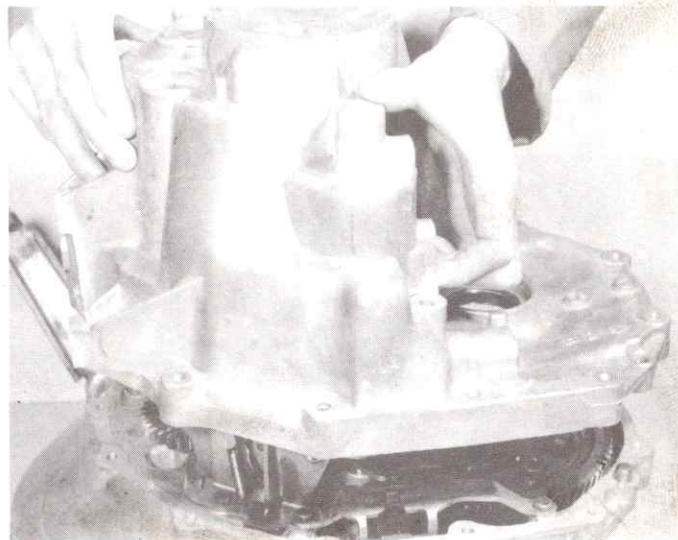
6.3C Shift check plug ...



6.3D ... and the reverse check plunger assembly



6.4A Transmission case bolts



6.4B Separating the halves

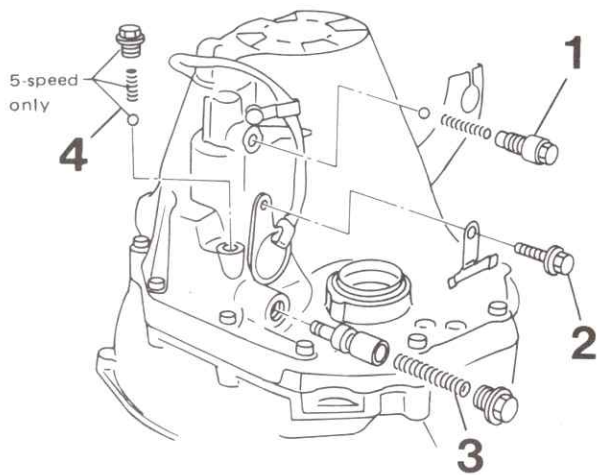


Fig. 6.3 Remove the four plugs as shown (Sec 6)

- |  |                              |
|--|------------------------------|
| 1 Shift check plug                       | 3 Reverse check plunger      |
| 2 Special bolt on reversing light switch | 4 5th and reverse check plug |

#### Transmission casing

5 There are four items in the transmission casing which need to be inspected. They are: the input shaft rear bearing, the mainshaft rear bearing outer race, the differential side bearing outer race, and oil seal (photo).

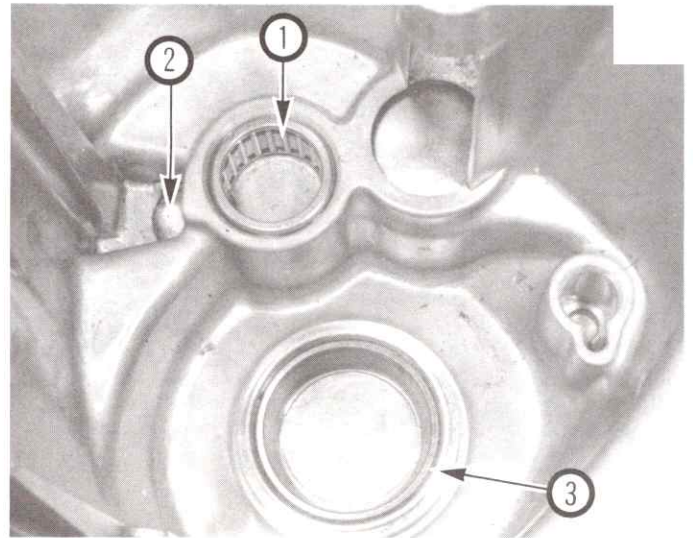
6 Bearings should be inspected generally for blueing (burning), scoring, pitting and signs of wear or break up, and renewed as necessary. If any of these bearings are renewed, then the preload adjustment procedures described in Section 9 will have to be complied with.

7 To remove the input shaft rear bearing, remove the small welch plug from the transmission case, which will allow the bearing to be pressed out, using a suitably sized drift.

8 Apply sealant to a new welch plug and fit it before pressing home a new bearing.

9 The mainshaft rear bearing outer race has to be removed using a puller (photo) and the new bearing pressed home with a large diameter mandrel. Remember to check on the bearing preload procedures at this stage.

10 The differential side bearing outer race is removed by carefully tapping it from its housing using a soft metal drift, and a new bearing fitted in the same manner, again referring to the section on bearing preload adjustment (photos).



6.5 View inside the transmission rear casing

- 1 Input shaft rear bearing 3 Mainshaft rear bearing  
2 Welch plug

#### Clutch housing

11 The clutch housing will have been left standing with the geartrains projecting from it when the transmission casing was lifted off.

12 Begin dismantling by first removing the guide plate, held by two bolts.

13 Remove the reverse idler gear and shaft.

14 Remove the three bolts and lift off the bearing retainer.

15 Raise both input and mainshaft assemblies just enough to allow the final drive assembly to be lifted out.

16 Remove the bolts which hold the shift rod plate and lift out the input shaft, mainshaft, shift forks and fork rods as one unit.

17 Remove the retaining pin and lift out the shifter, complete with its shaft.

18 Remove the small welch plug in the housing then knock out the retaining pin and remove the select lever and striking rod.

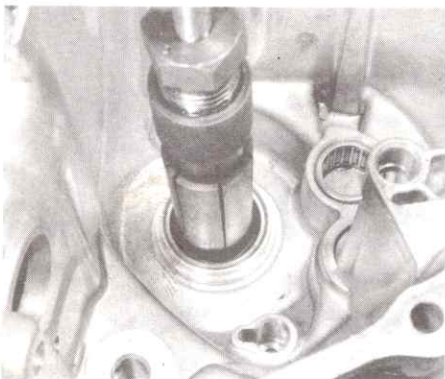
19 Remove the input shaft oil seal (photo) and the oil seals fitted to the clutch control shaft and the striking rod housings.

20 Using a puller with thin fingers, remove the mainshaft bearing outer race, being careful to avoid damage to the plastic oil channel.

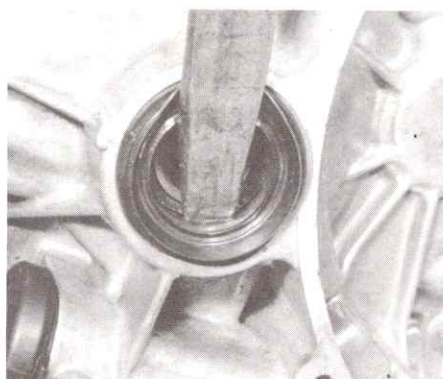
21 Lift out the plastic oil channel (photo).

#### Input shaft

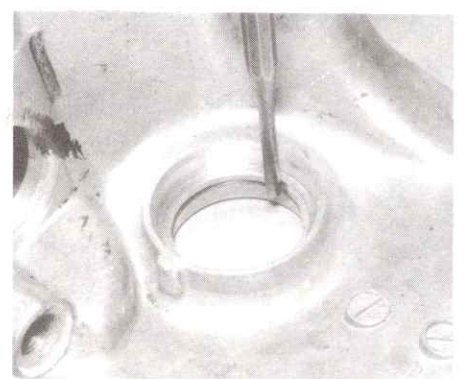
22 Place the input shaft in a padded vice, front bearing uppermost (photo).



6.9 Removing the mainshaft rear bearing outer race



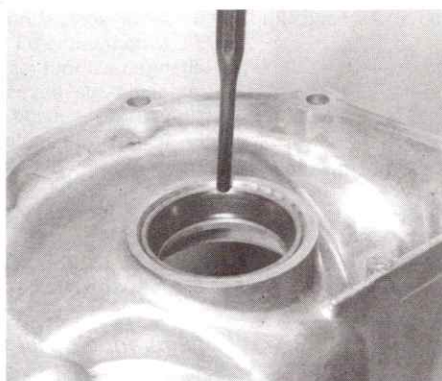
6.10A Levering out the differential side bearing oil seal



6.10B Tap out the side bearing



6.10C Side bearing shims



6.10D Tap home the side bearing



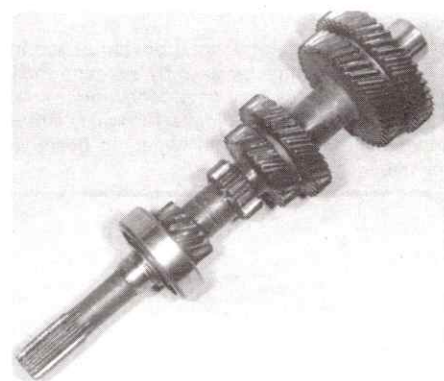
6.10E Fit the oil seal



6.19 Remove the input shaft oil seal using a puller



6.21 Plastic oil channel



6.22 The input shaft

23 Remove the snap-ring and thrust washer before pulling off the front bearing (photo).

24 The input shaft cannot be dismantled any further.

### Mainshaft

25 Before dismantling any part of the mainshaft, measure the endfloat of the gears and check results with the tolerances given in the Specifications. If the endfloat measurement of any component is

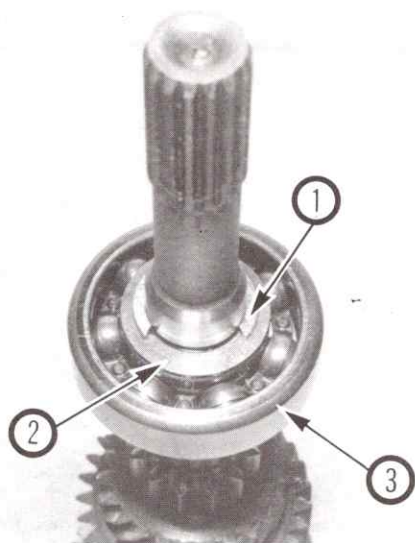
outside of the tolerance range then inspect all components carefully on dismantling, renewing any found worn.

26 Using a bearing puller, remove the mainshaft bearing, 5th gear synchroniser, and 5th gear (photo).

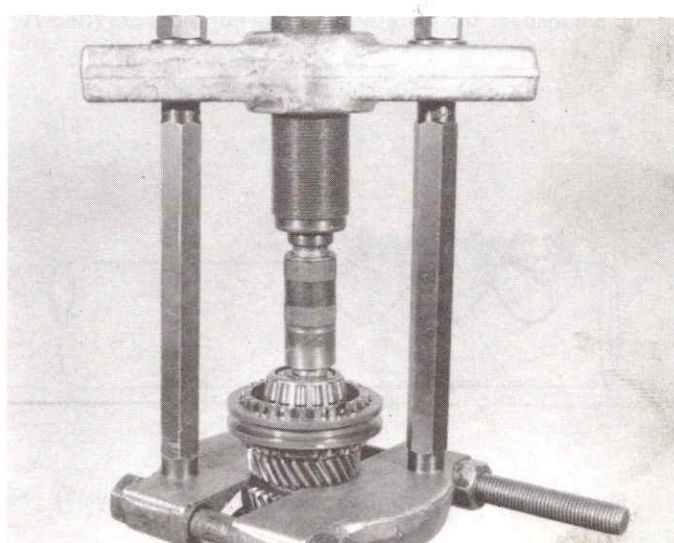
27 Remove the 5th gear bushing, 4th gear and snap ring.

28 Remove 3rd and 4th gear synchroniser, and 3rd gear, again using a bearing puller.

29 Remove the snap-ring, then lever off the thrust washer and remove the steel ball.



6.23 Input shaft front bearing  
 1 Snap-ring      3 Bearing  
 2 Thrust washer



6.26 Pulling off mainshaft bearing

30 Remove 2nd gear and snap-ring, then remove 1st and 2nd synchroniser hub and 1st gear.

31 Remove the mainshaft front bearing inner race.

### Differential/final drive

32 Unbolt the crownwheel from the differential case.

33 Remove the differential side bearing inner races. Do not mix the left and right-hand bearings.

34 Using the pin punch, drive out the pinion mate shaft lock pin and draw out pinion shaft.

6 All oil seals should be replaced as a matter of course.

7 Note that the oil seals fitted to the differential side bearings may be changed without removing the gearbox. Access to the seals is made by removing the driveshafts. They should be changed at the slightest signs of oil seepage.

8 Inspect the components of the selector assembly, especially in the areas where the ends of the operating 'fingers' contact other components.

9 Look for cracks, distortion and general wear.

## 8 Transmission – reassembly

### 7 Transmission components – inspection

1 With the transmission completely dismantled, clean all components thoroughly before inspecting them.

2 Inspect gear wheels for chipped or worn teeth, and their bushes for wear.

3 Inspect shafts for wear, grooving or scoring.

4 Inspect bearings for wear by spinning them. Any signs of slackness or rattles indicates they need renewing.

5 Check synchroniser units for wear, although this will have been apparent from difficulty in engaging gears when the gearbox was in service.

### Differential/final drive

1 Fit the side gears together with their thrust washers, and then install the pinion mate washers and pinion mate gears in place in the differential housing.

2 Insert the pinion mate shaft through one of the side holes, sliding each component on to it as you proceed, being especially careful not to damage the pinion mate washers.

3 With all components in place in the housing the side gear to pinion mate gear clearance should be measured and checked with the tolerances given in the Specifications.

4 Use a dial gauge, and if available the special tool, set up as shown in Fig. 6.10.

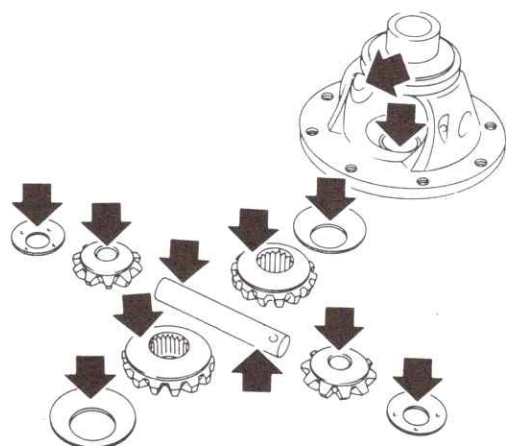


Fig. 6.4 Inspect the differential drive components (Sec 7)

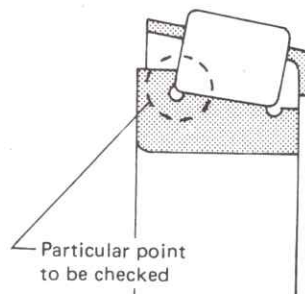


Fig. 6.5 Inspect taper roller bearings (Sec 7)

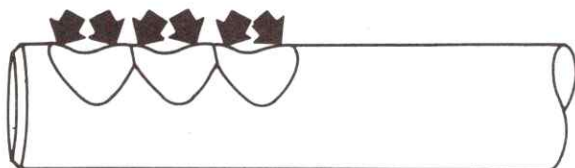


Fig. 6.6 Areas of particular wear on fork rod (Sec 7)

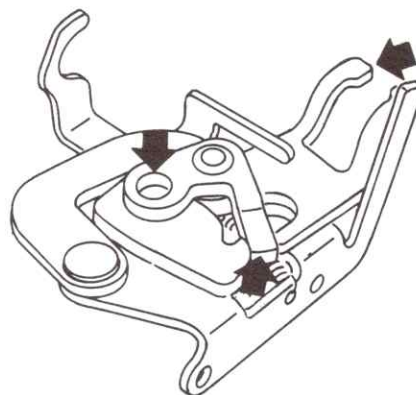


Fig. 6.7 Reverse bracket assembly wear points (Sec 7)

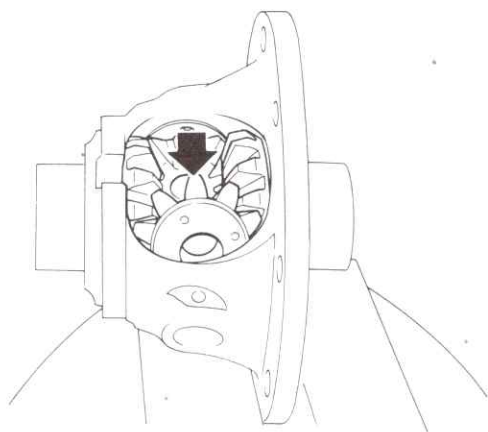


Fig. 6.8 Install the components of the differential housing (Sec 8)

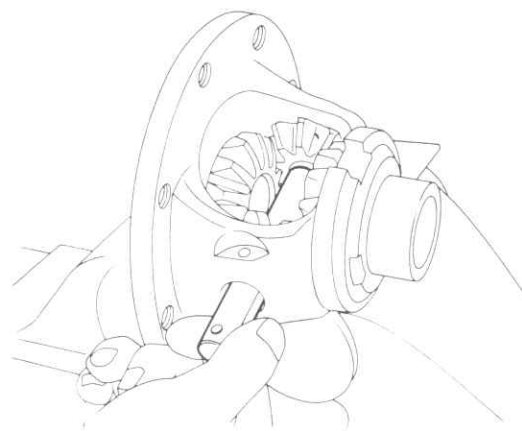


Fig. 6.9 The pinion mate shaft (Sec 8)

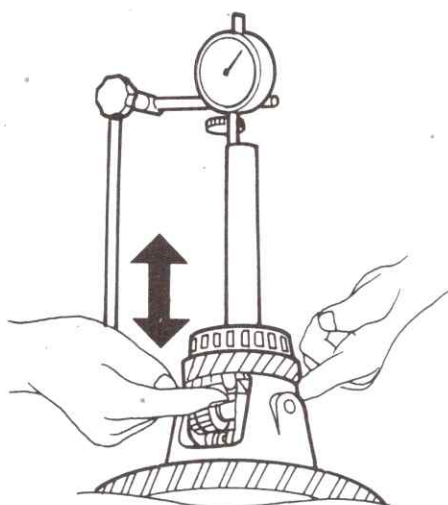
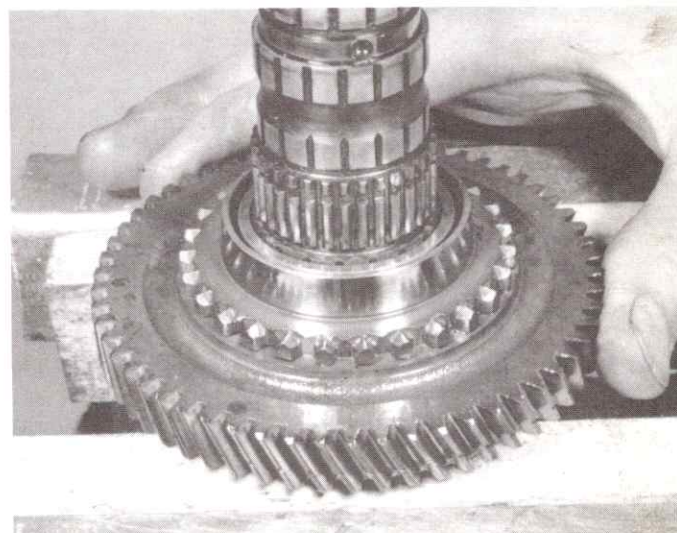


Fig. 6.10 Checking side gear to pinion mate gear clearance (Sec 8)



8.10 Mainshaft and front bearing



8.11 1st gear in position

5 If the tolerances cannot be met, then refer to the Specifications for thrust washer thicknesses.

6 Once the correct tolerances are achieved, lock the whole assembly by punching in a new roll pin.

7 Make sure the roll pin is flush with the casing before bolting on the final drivegear, using a thread locking compound and tightening to the specified torque.

8 Fit the speedometer drivegear and stopper, before finally pressing on the differential side bearing inner race.

#### Mainshaft

9 To ensure correct assembly, refer at all times to the photos and the exploded view of the gear components. Oil all parts liberally as they are fitted.

10 Press on the mainshaft front bearing, ensuring it is pushed fully home (photo).

11 Place the shaft in a padded vice and slide on 1st gear (photo).

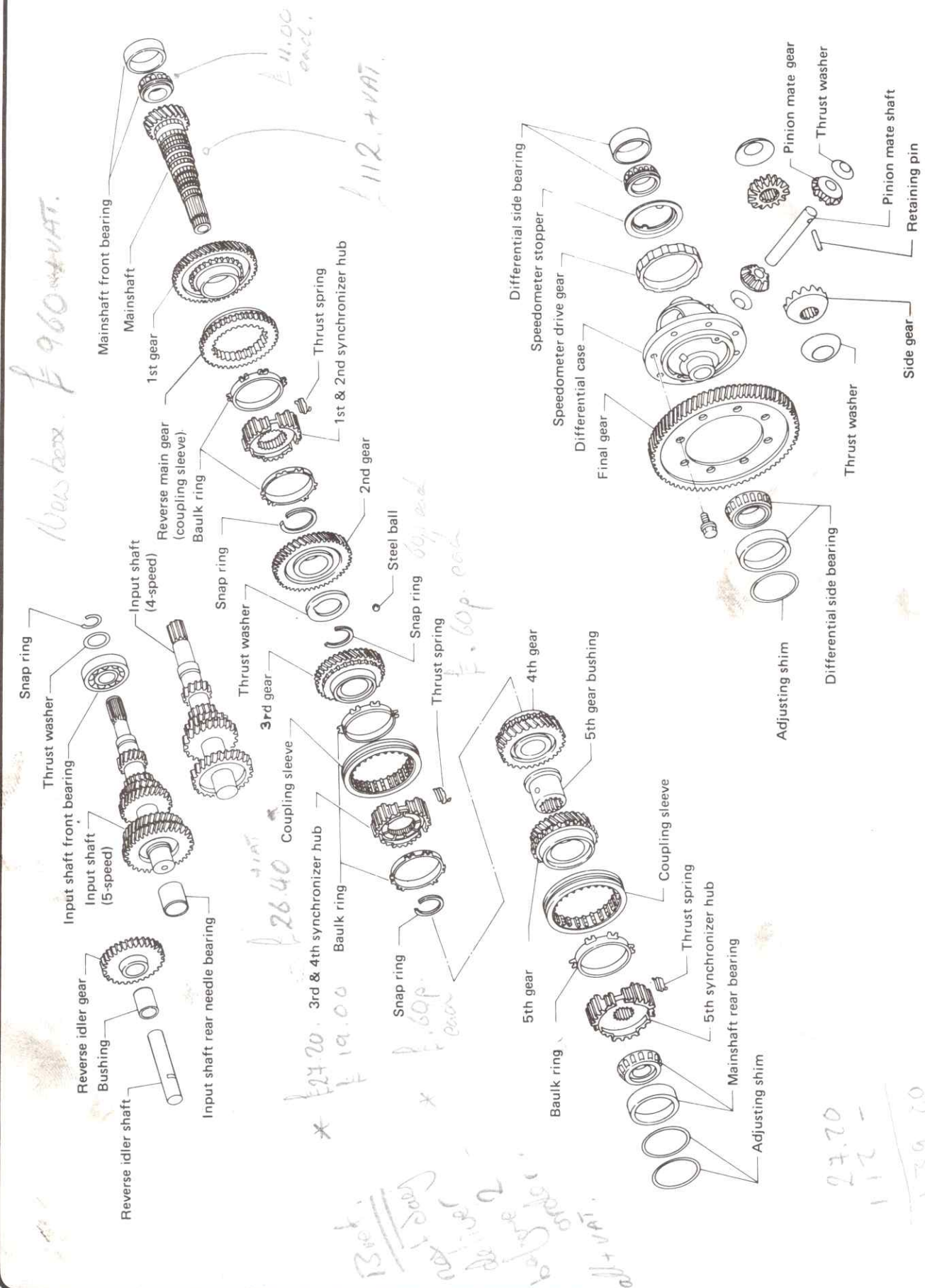


Fig. 6.11 Geartrain components (Sec 8)

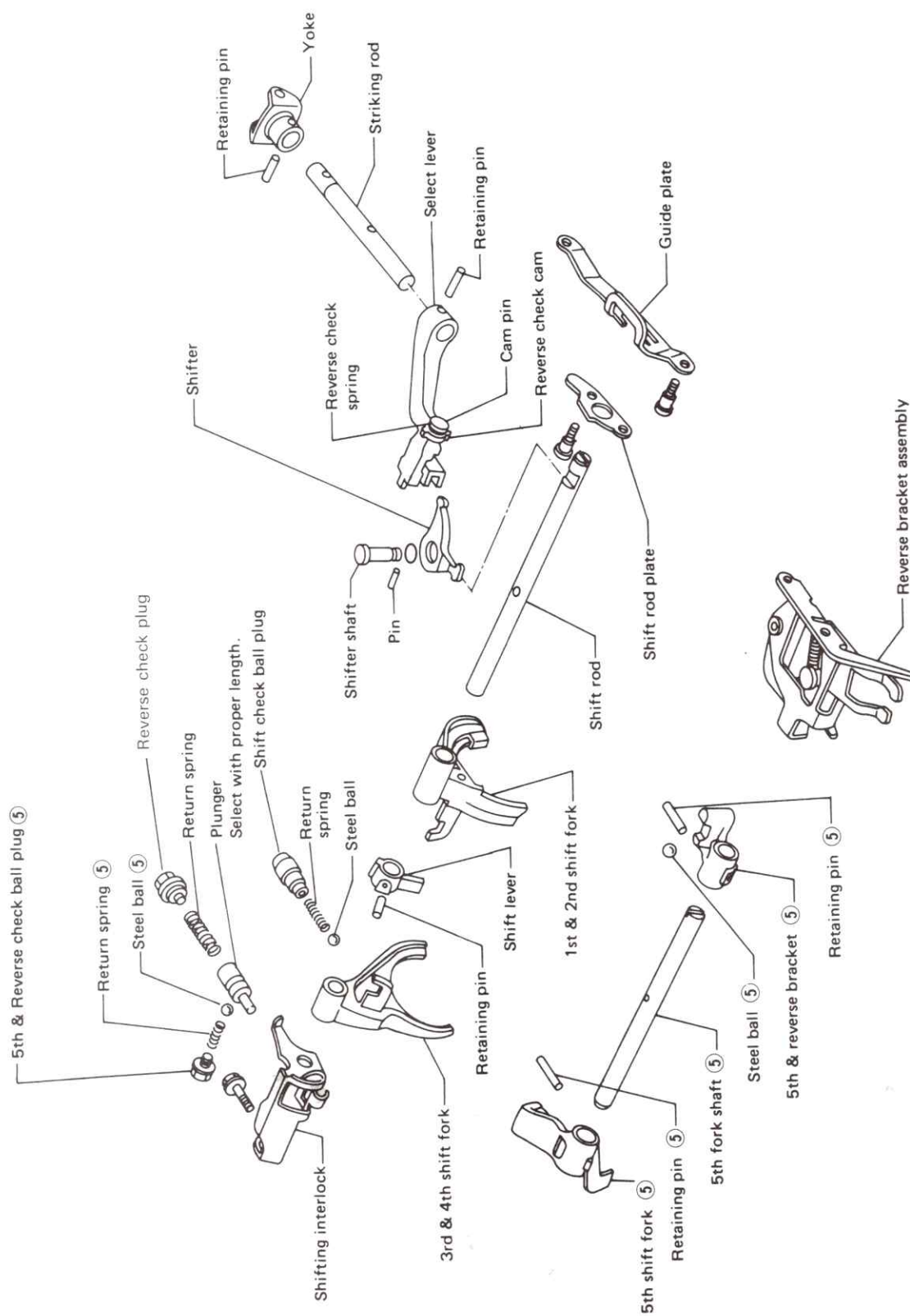
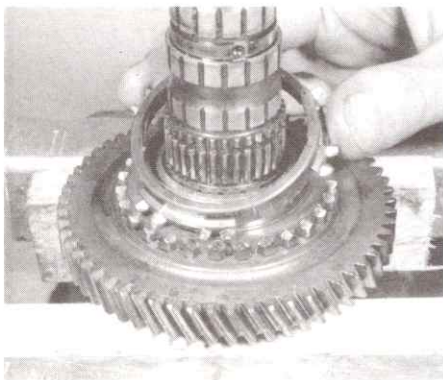
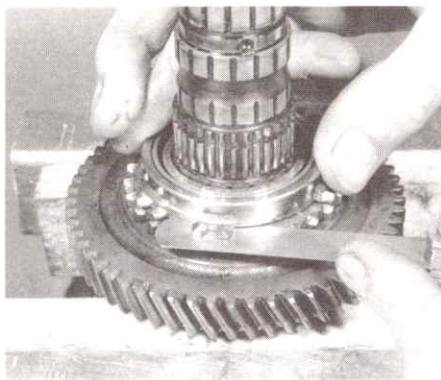


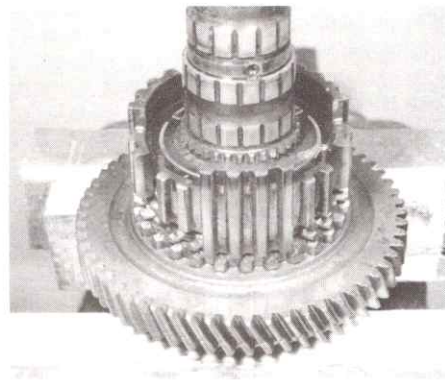
Fig. 6.12 Gear change shift components (Sec 8)



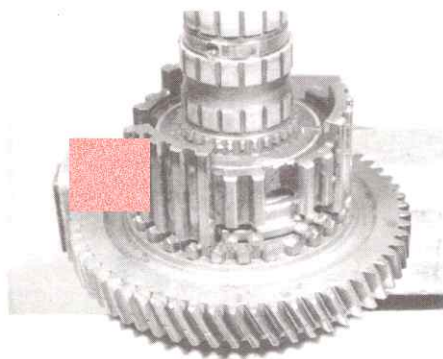
8.12 Fit the baulk ring, teeth nearest 1st gear



8.13 Measuring the clearance



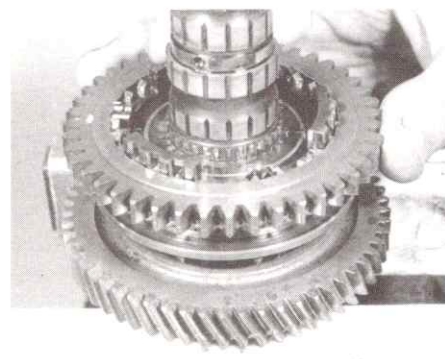
8.14A Fitting 1st and 2nd gear ...



8.14B ... synchroniser hub



8.15 Fit the thrust springs



8.16 Slide on the reverse main gear

12 Fit the first part of the baulk ring, ensuring its teeth are towards 1st gear (photo).

13 Holding the baulk ring firmly down, measure the gap between it and the face of 1st gear (photo) and ensure the tolerances in the Specifications are met. If not, renew the baulk ring.

14 Fit the 1st and 2nd gear synchroniser hub (photos).

15 Fit the three thrust springs to the reverse main gear (coupling sleeve) (photo).

16 Slide the reverse main gear onto the shaft and over the synchroniser hub, ensuring all parts mesh correctly (photo).

17 Fit a snap-ring, ensuring that it fits snugly down into its groove, and that it is of a thickness that will allow the tolerances of the groove

in the mainshaft to be met (see Specifications) (photo). **Note:** Snap-rings are available in two thicknesses

18 Slip the second part of the baulk ring into position on synchroniser hub (photo).

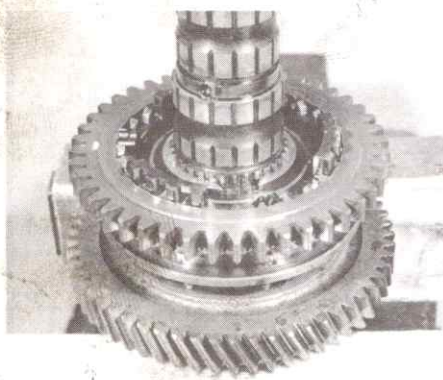
19 Fit 2nd gear (photo).

20 Fit the steel ball into its recess in the shaft (photo).

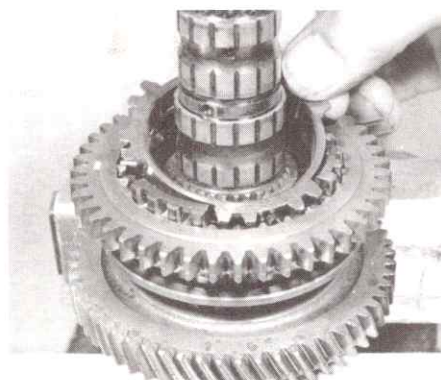
21 Then fit the steel thrust washer so that its cut out will keep the ball in position (photo).

22 Fit another snap-ring, again ensuring it fits snugly down into its groove, and meets the tolerances in the Specifications (photos).

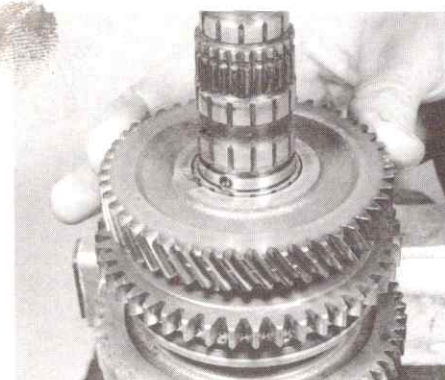
23 Fit 3rd gear (photo).



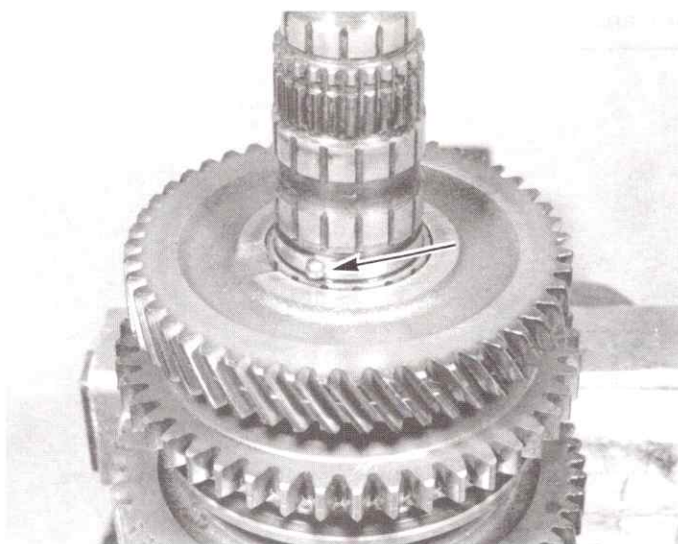
8.17 Fit the snap-ring



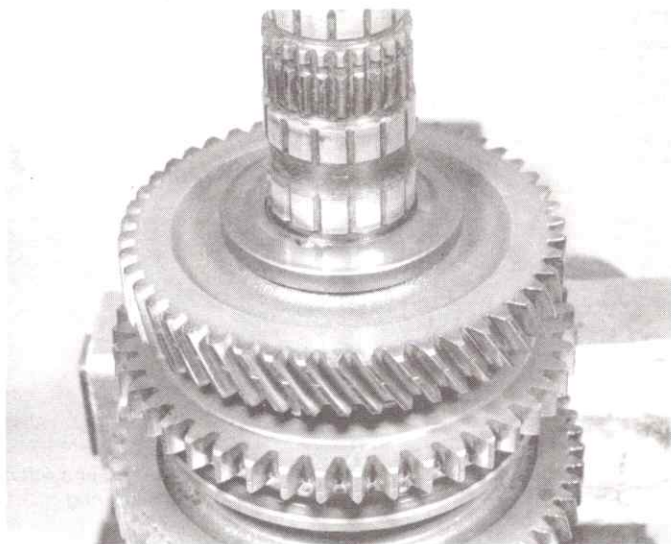
8.18 Second part of baulk ring



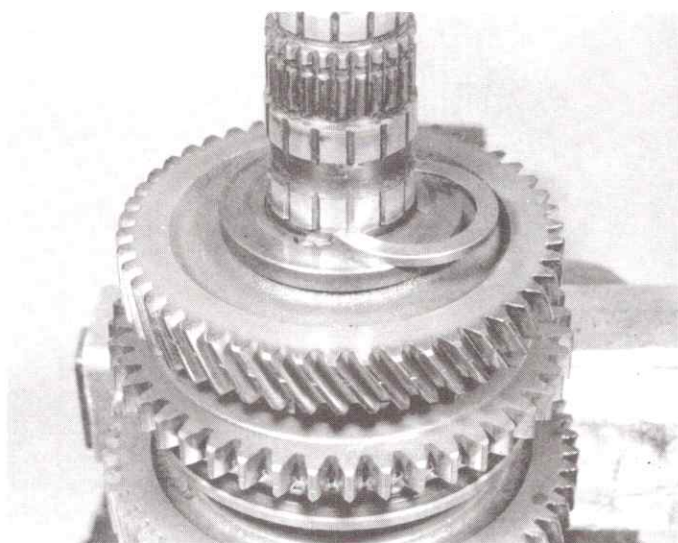
8.19 Slide on 2nd gear



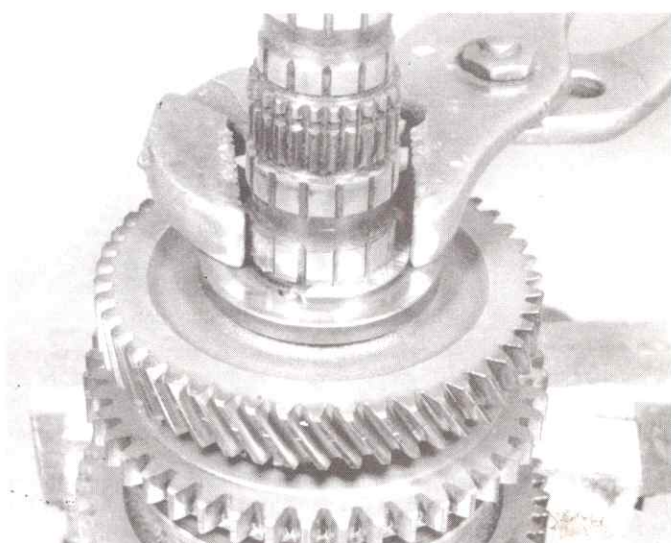
8.20 The steel ball ...



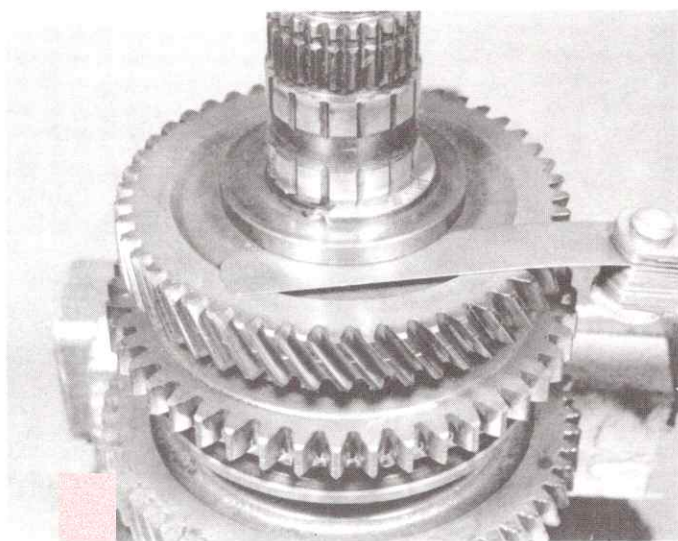
8.21 ... retained by the thrust washer



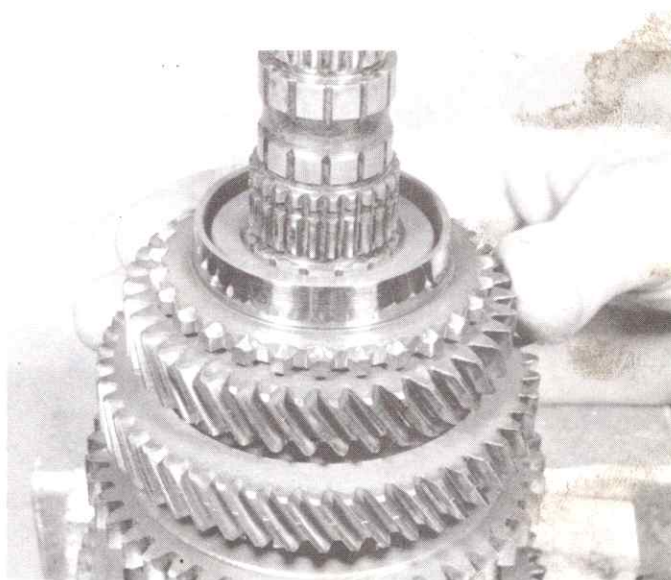
8.22A Fitting a snap-ring ...



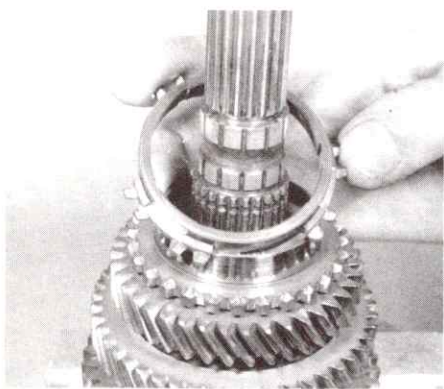
8.22B ... ensuring it fits snugly in the groove



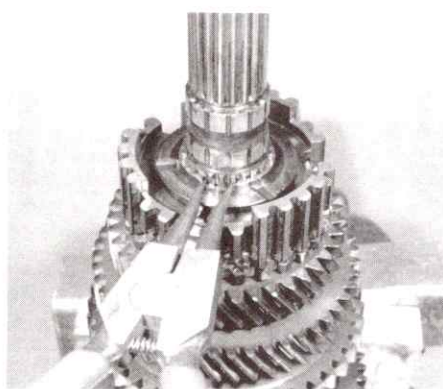
8.22C Measuring the groove clearance



8.23 Fitting 3rd gear



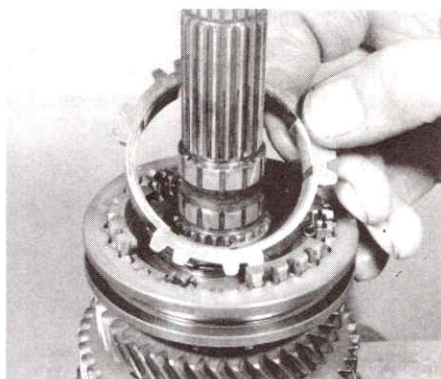
8.24 3rd gear baulk ring



8.25A 3rd and 4th gear synchroniser hub and snap-ring



8.25B 3rd and 4th gear coupling sleeve



8.25C Second part of baulk ring



8.27 Fitting 4th gear

24 Fit the first part of the 3rd gear baulk ring, teeth towards 3rd gear (photo).

25 Fit 3rd and 4th gear synchroniser hub coupling sleeve with thrust springs, and the second part of the baulk ring, as described earlier for 1st and 2nd gear (photos).

26 Fit a further snap-ring, complying with the tolerances as described earlier.

27 Fit 4th gear (photo).

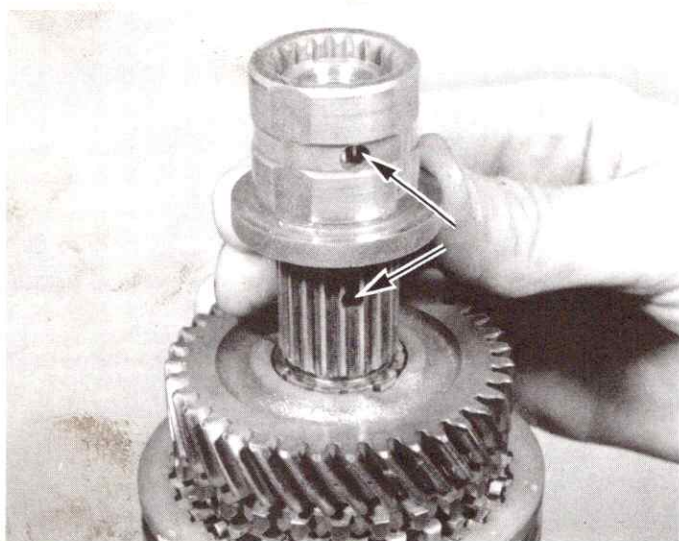
28 Fit 5th gear bush, lining up the holes (photo).

29 Slide 5th gear onto the shaft (photo).

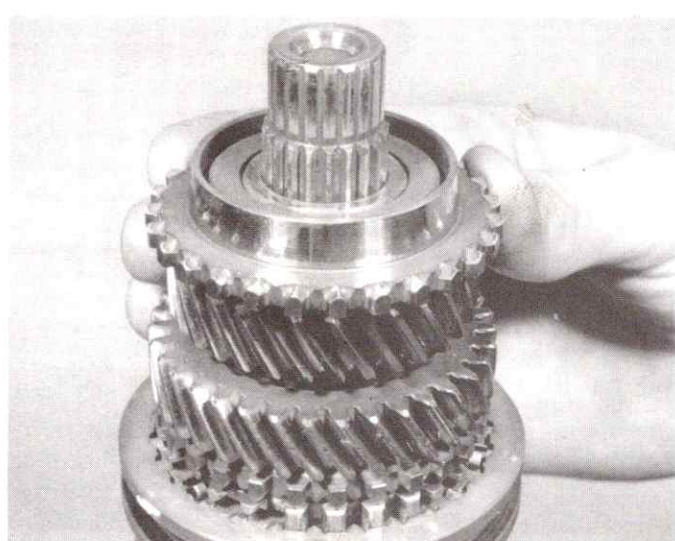
30 Install the 5th gear baulk ring (photo), coupling sleeve, and synchroniser assembly (photo).

31 Press fit the mainshaft rear bearing (photos).

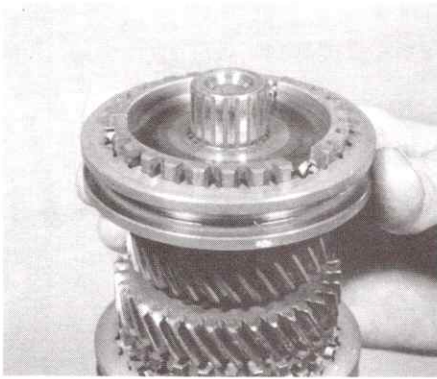
32 With the mainshaft fully assembled and all parts pressed fully home together on the shaft, measure gear endfloat, comparing the results for each gear with the table in the Specifications (photo).



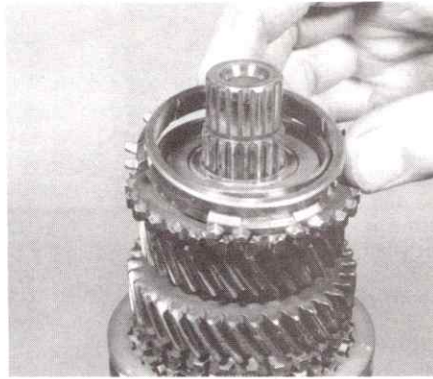
8.28 Line up the holes (arrowed) and fit 5th gear bush



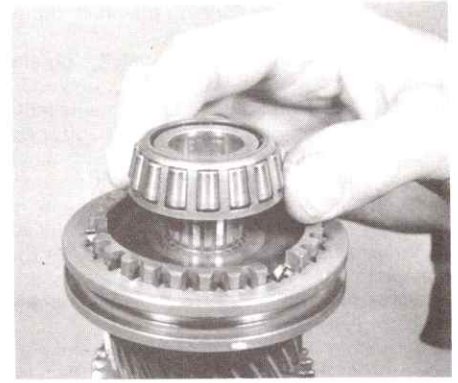
8.29 Slide on 5th gear



8.30A Assemble the components ...



8.30B ... of the synchro unit



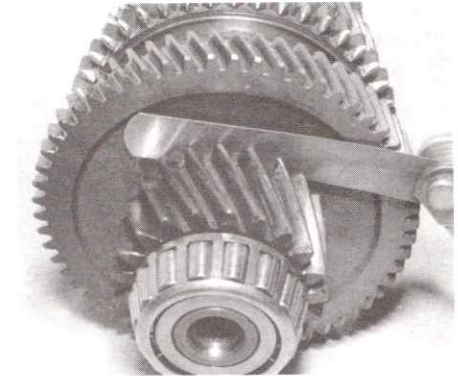
8.31A Fitting the mainshaft main bearing ...



8.31B ... onto the shaft



8.31C Pressing it fully on to the shaft



8.32 Measuring gear endfloat

### Input shaft

33 Press fit a new input shaft front bearing onto the input shaft.  
 34 Fit a new thrust washer, or gear spacer as it is sometimes called, and then fit a snap-ring of suitable thickness to allow the tolerances in the Specifications to be met. **Note:** These snap-rings are available in three thicknesses.

### Clutch housing

35 Fit a new plastic oil channel, ensuring its cut-out portion lines up

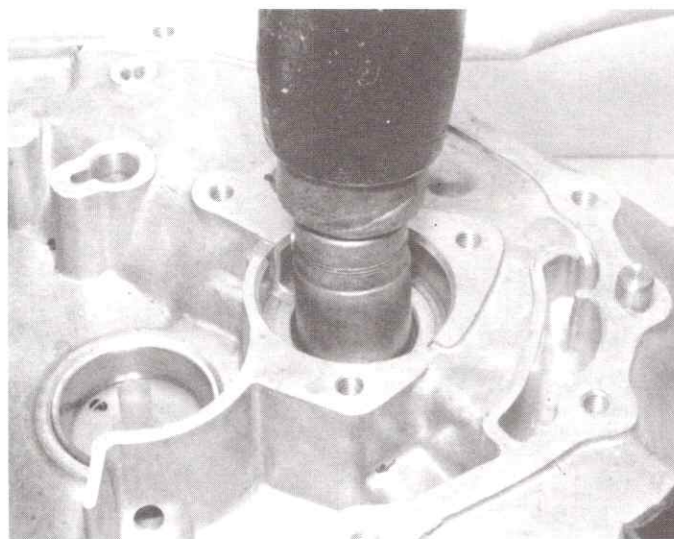
with the cut-out in the bearing housing.

36 Fit a new mainshaft front bearing outer race, tapping it home with a suitable size drift.

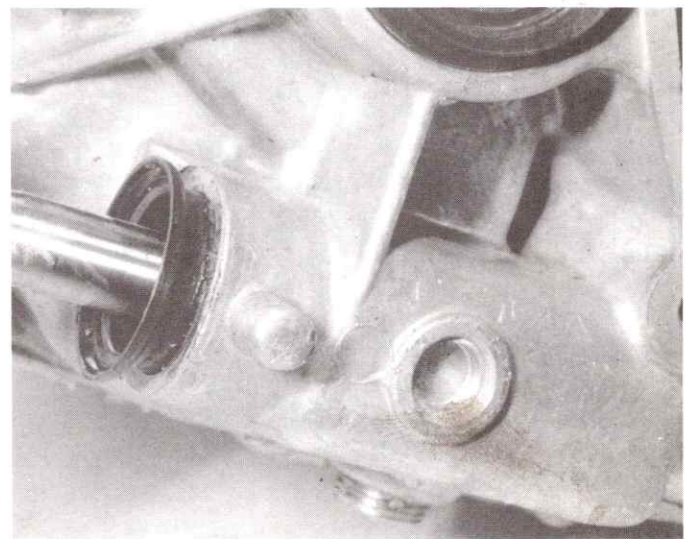
37 Fit a new input shaft oil seal, again tapping it home with a socket (photo).

38 Similarly, fit a new seal to the clutch control shaft aperture and selector lever aperture (photo).

39 Fit a new rubber boot to the selector lever and insert it into the casing at the same time fitting the strike cover, so that the selector lever



8.37 Using a socket to tap home the oil seal



8.38 Select lever oil seal

enters the strike lever. Line up the holes and punch in a new retaining pin (photo).

40 Apply sealant to the small welch plug and tap it into its housing (photo).

41 Fit the select shifter and tap home its retaining pin (photo).

42 At this point with the mainshaft and input shaft built up, and all bearings fitted to the transmission and clutch housing casings, it is necessary to determine the driveshaft preload, which is set by fitting shims under the rear bearing outer race. Refer to the section on mainshaft and differential side bearing preload adjustment.

43 Wrap some tape around the splines of the input shaft to prevent damage to the oil seal.

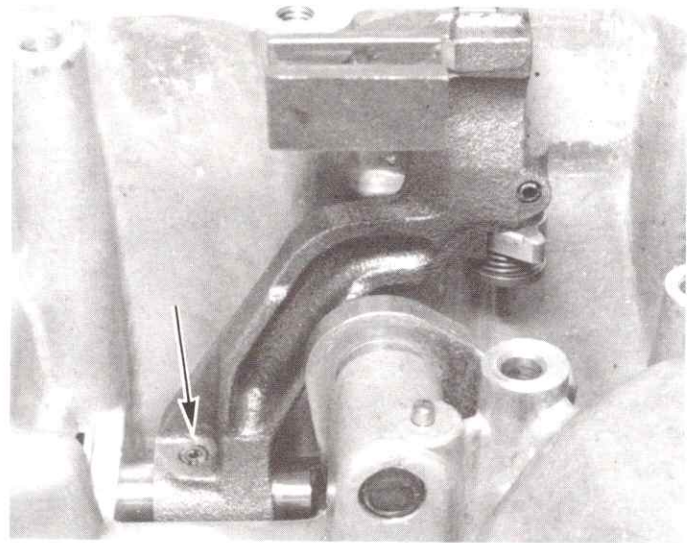
44 Place the input shaft together with the mainshaft, so that they mesh correctly (photos).

45 Assemble the shift forks, shift interlock and shift rod, using new locking pins if the forks were dismantled for repair or replacement (photos).

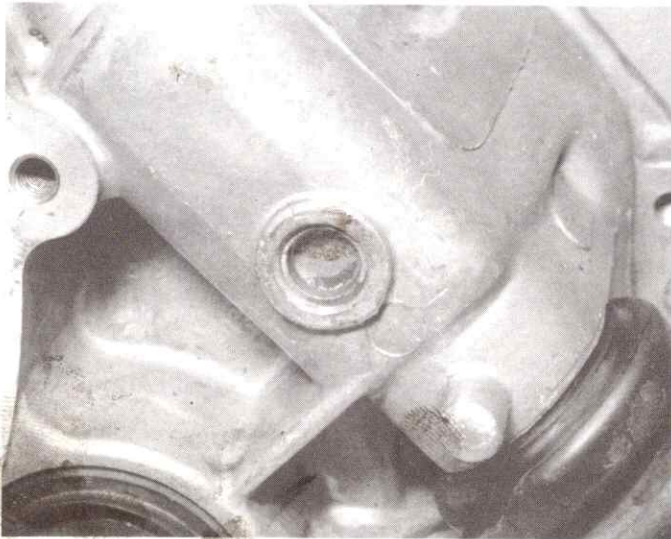
46 Place the shift fork assembly onto the mainshaft and input shaft, engaging the forks with the channels in the coupling sleeves (photos).

47 Gently lower the whole assembly into the clutch housing, so that the mainshaft and input shaft enter their respective bearings (photo).

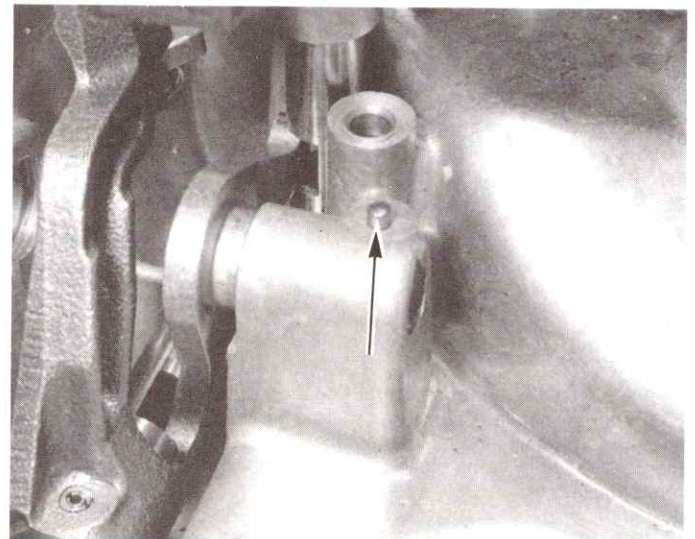
48 Ensure that the grooves in shift lever and strike lever are engaged properly (photo).



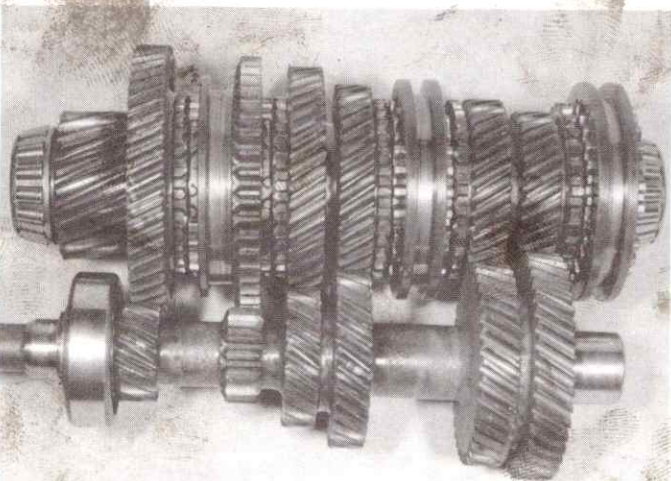
8.39 Tap in a new retaining pin (arrowed)



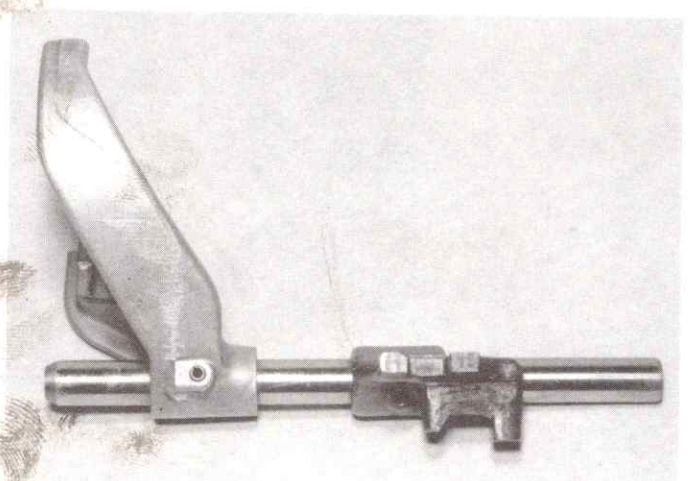
8.40 Fit the small welch plug



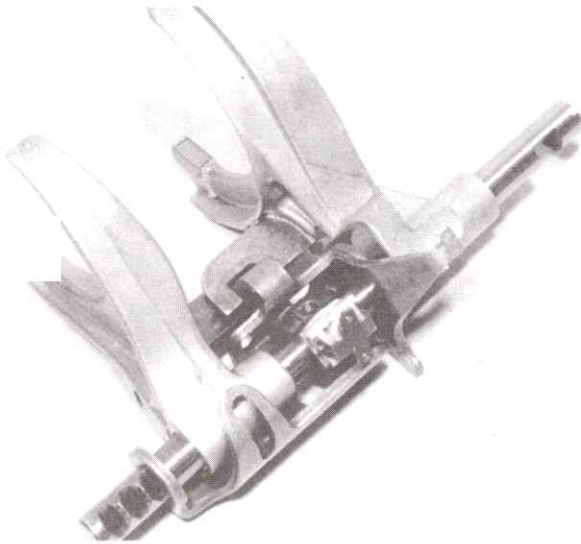
8.41 Select shifter retaining pin



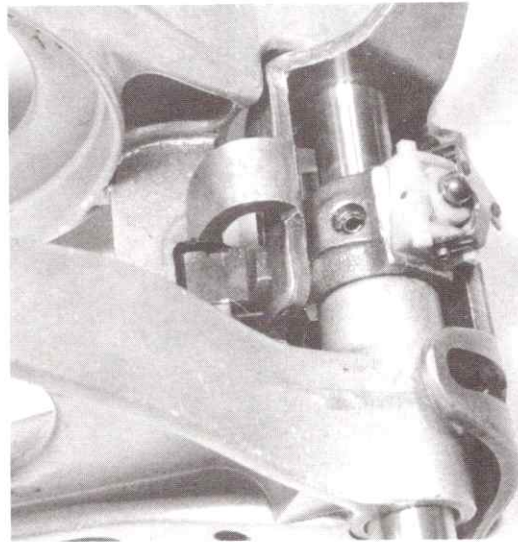
8.44 Assemble the two shafts together



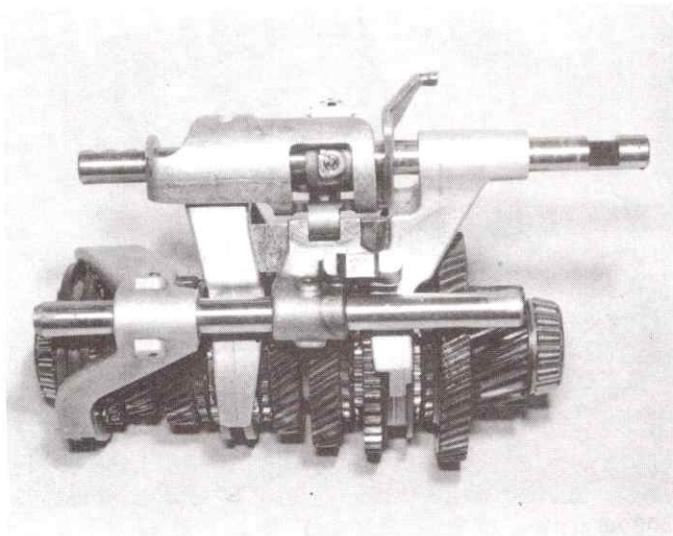
8.45A Assemble the shift forks ...



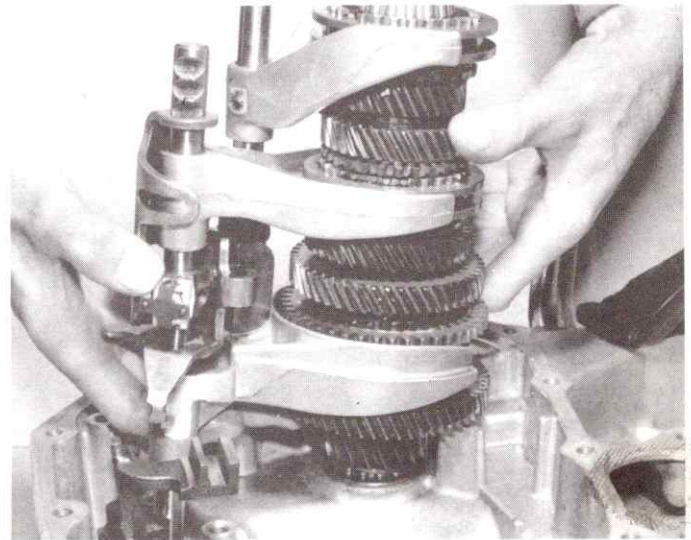
8.45B ... and shift interlock ...



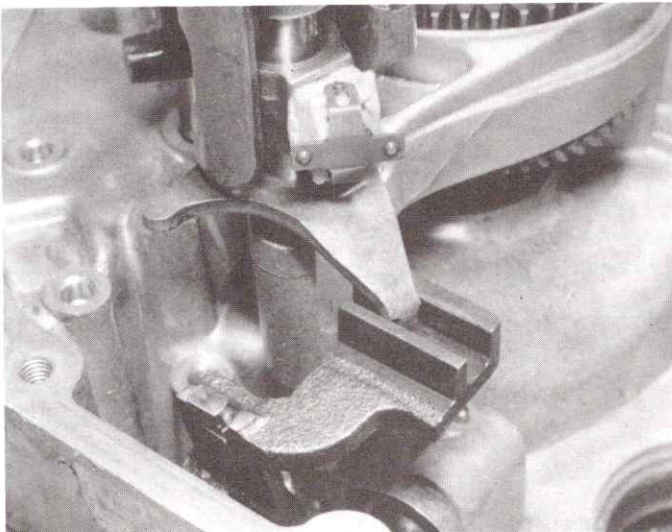
8.45C ... using new locking pins



8.46 Placing the shift fork assembly into position

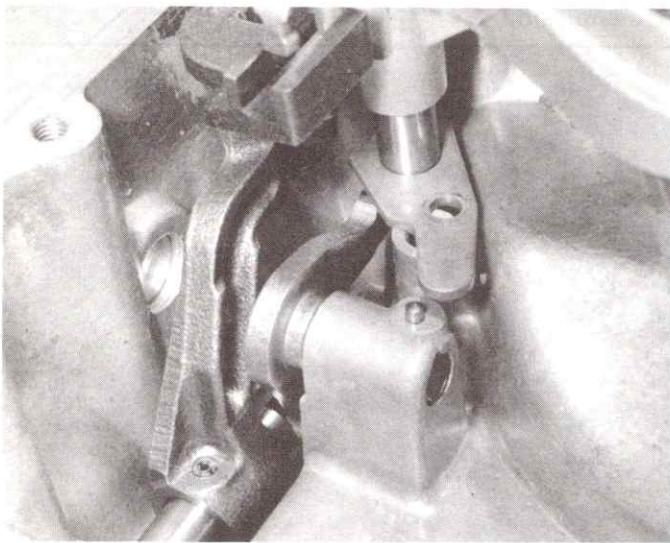


8.47 Lowering the geartrain assembly into the housing

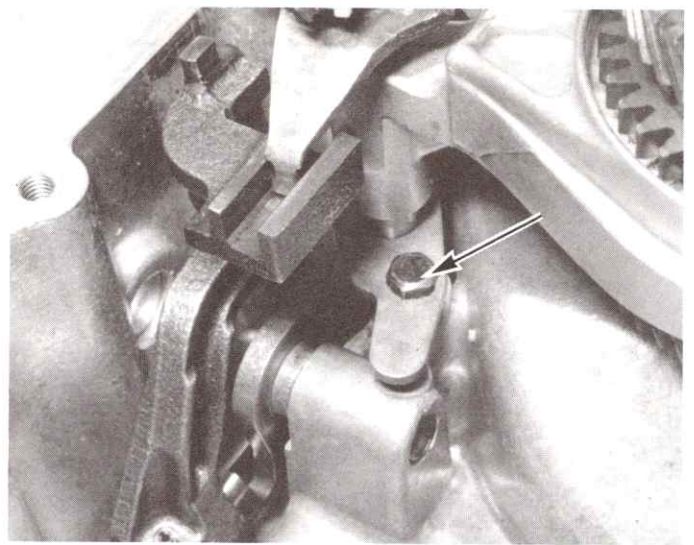


8.48 Engaging the levers

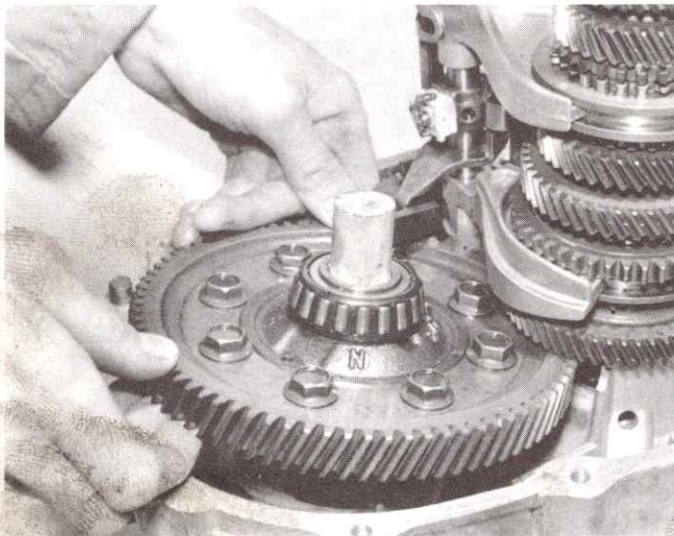
- 49 Fit the shift rod plate and tighten the bolt (photos).
- 50 Lift both the input and mainshaft assembly slightly, to allow the final drive assembly to be lowered into position (photos).
- 51 Re-seat the shafts and fit the bearing retainer and bolts (photos).
- 52 Fit the reverse idler gear and shaft so that the slot in the shaft will engage with the reverse bracket assembly (photos).
- 53 Place the small magnet in position (photo) and then fit the reverse bracket assembly (photos) tightening the securing bolt before fitting the guide plate. Note the centre bolt secures both items.
- 54 Apply sealing compound to the mating face of the transmission case and fit it to the clutch housing, ensuring it is seated correctly over the dowels before tightening the bolts.
- 55 Select 4th gear, then, using a slim depth gauge, measure the distance X given in Fig. 6.13. This is measured from the bottom of the housing into which the reverse check plug screws to the striking interlock (within the transmission) (photo).
- 56 This measurement will determine which of the four different lengths of available plunger to use. See Specification table. After selecting a suitable length plunger, fit it and its spring, and fit and tighten the plug (photo).
- 57 Fit the 5th and reverse check plug, and the shift check plug, ensuring the steel balls and springs are correctly positioned and use sealing compound on the plug threads (photos).



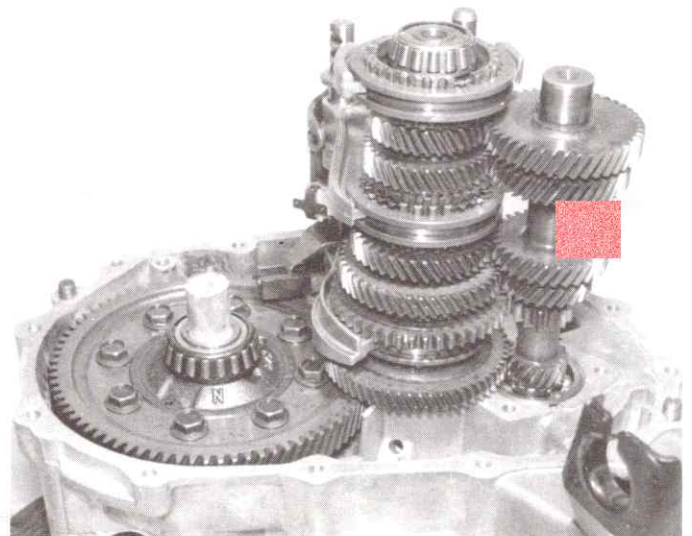
8.49A Fit the shift rod plate ...



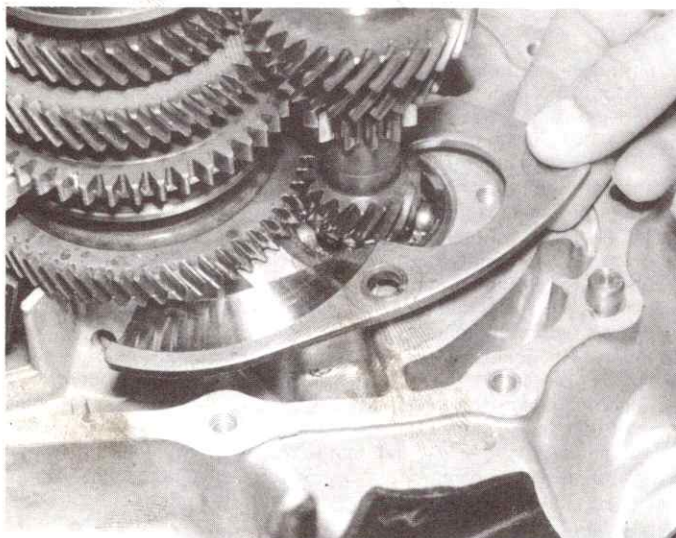
8.49B ... and tighten the bolt



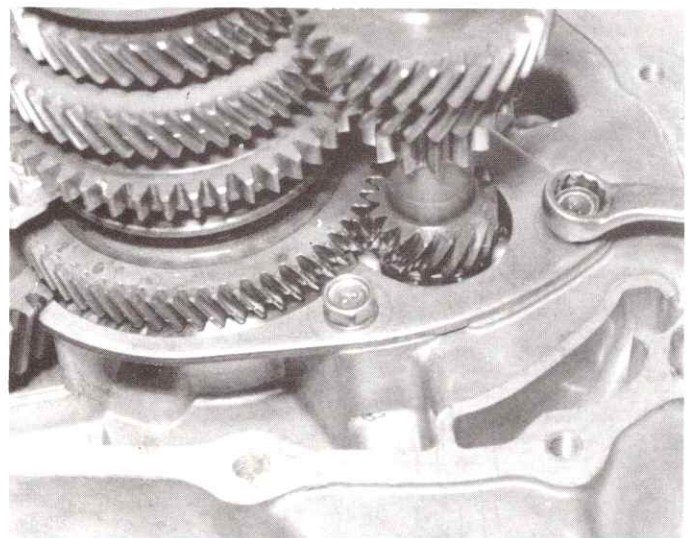
8.50A Fitting the final drive assembly



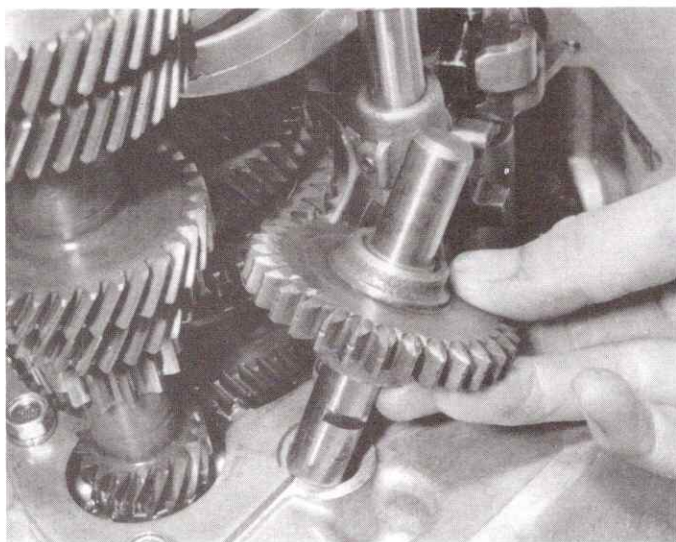
8.50B All in place



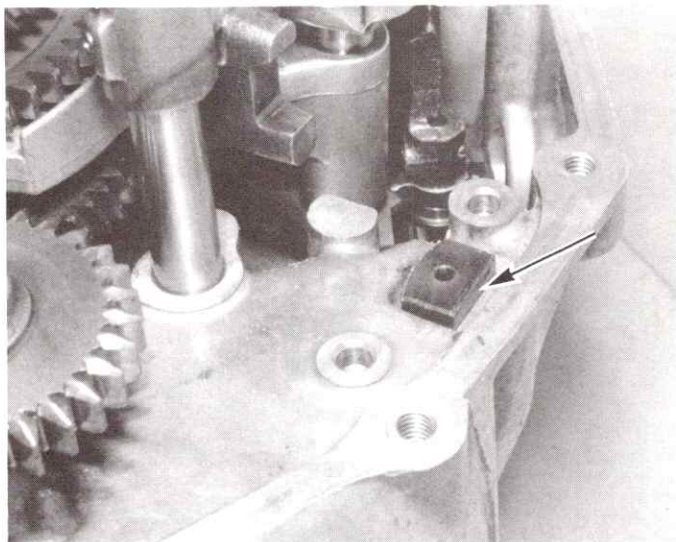
8.51A Fit the bearing retainer ...



8.51B ... and tighten the bolts



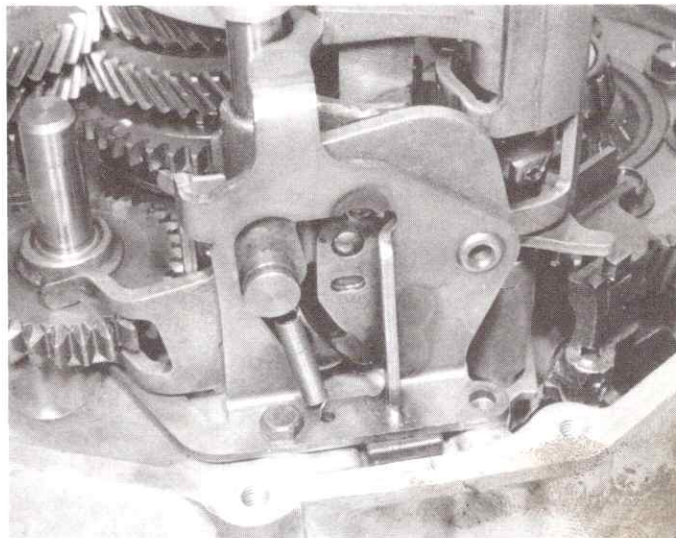
8.52 Fitting the reverse idler gear and shaft



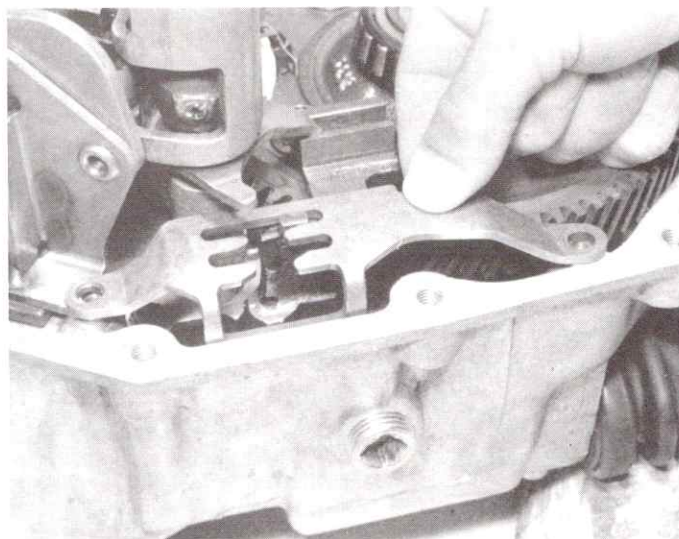
8.53A The small magnet in place



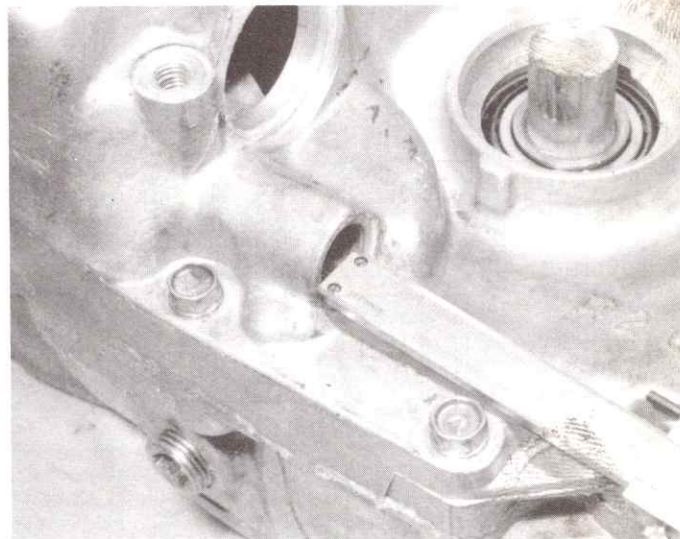
8.53B Reverse bracket assembly



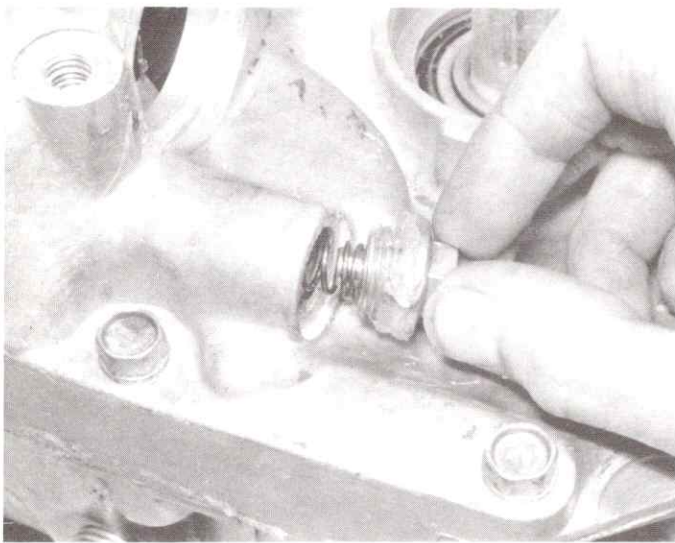
8.53C Reverse bracket being bolted in position ...



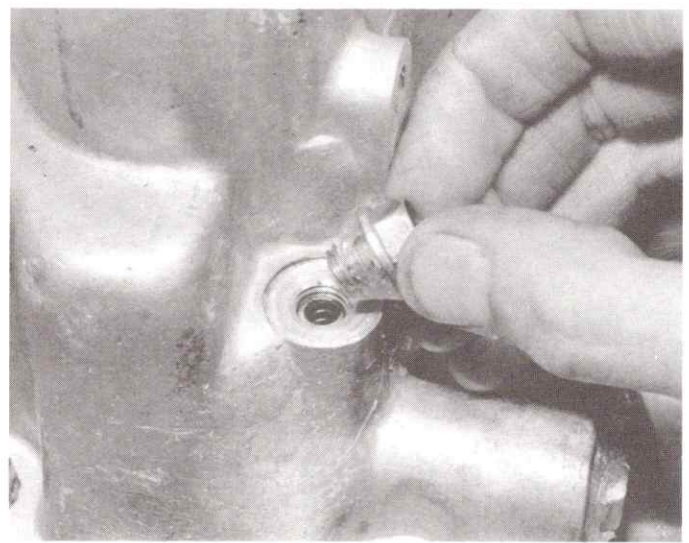
8.53D ... together with the guide plate



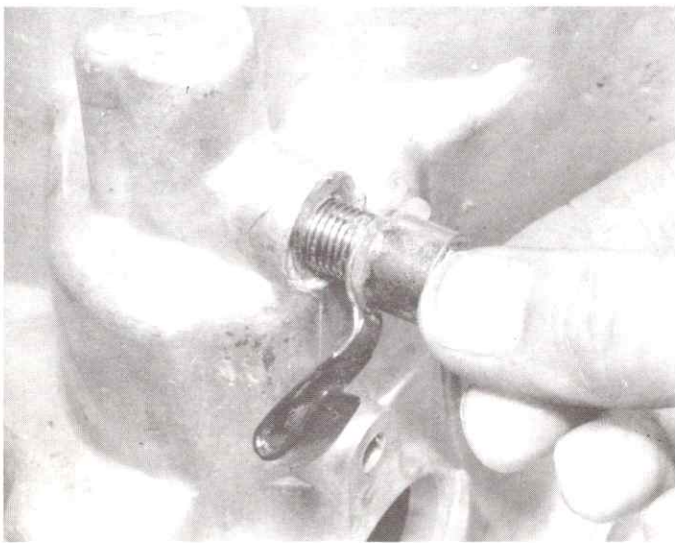
8.55 Preparing to measure the reverse check plunger depth



8.56 Reverse check plug assembly



8.57A 5th and reverse check plug



8.57B Installing the shift check plug



8.58 Fitting the reverse light switch and locking plate

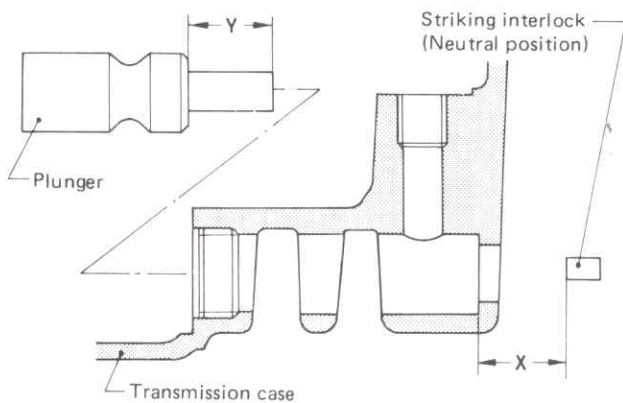
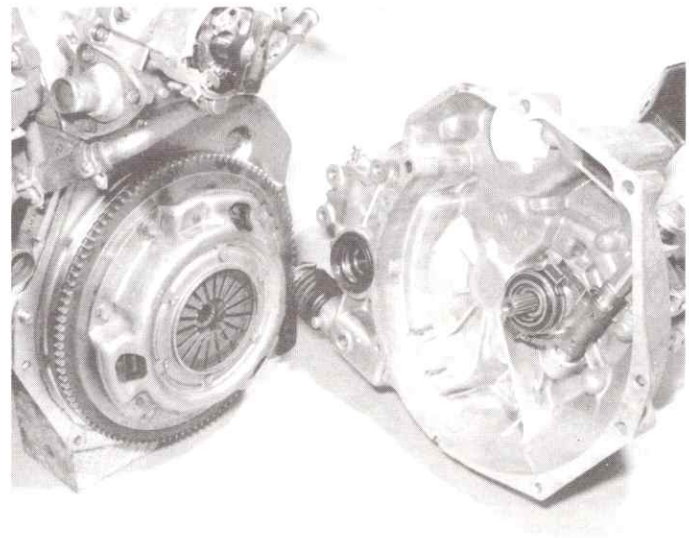


Fig. 6.13 Measure distance X to determine plunger length Y (Sec 8)



8.61 The unit ready for fitting to the engine

- 58 Apply sealing compound to the reverse light switch then fit it and its locking plate (photo).
- 59 After final assembly, check that all gears can be obtained smoothly and freely.
- 60 Measure the final turning torque as described in Section 9, preload adjustment.
- 61 Check over the unit to make sure everything has been replaced correctly, before refitting the transmission assembly to the engine (photo).
- 62 Refitting is a reversal of the removal sequence, remembering to fill the gearbox with oil, and adjust the clutch (Chapter 5) and refit the driveshafts (Chapter 8) and steering links (Chapter 10).

## 9 Mainshaft and differential bearing preload – adjustment

### *Bearing preload adjustment*

- 1 Whenever the bearings in the clutch housing, transmission case, mainshaft, differential case or taper rolling bearings are renewed, it is necessary to set the preload on them by fitting shims behind them, to achieve the tolerances laid down in the Specifications.

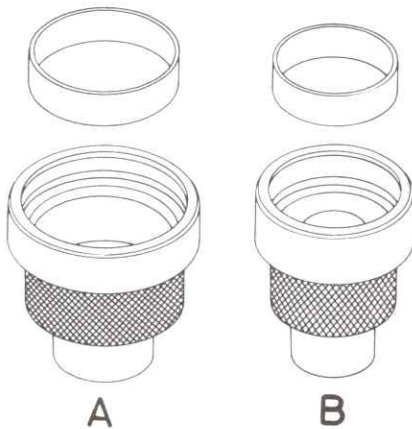


Fig. 6.14 Mainshaft and differential side bearing adjusters (Sec 9)

A Mainshaft adjuster

B Side bearing adjuster

- 2 This requires a set of special tools including bearing adjusters and transmission case support collars. If these are not available, then the unit should be taken to your dealer for adjustment.
- 3 If the transmission has been assembled using the original bearings and shims, then this procedure is not necessary, and the final turning torque figures will be somewhat lower than that given in the Specifications.
- 4 Both the mainshaft and differential side bearing preload adjustment can be carried out in one operation. Proceed as follows.
- 5 Remove the front and rear mainshaft outer bearings, shims and plastic oil channel.
- 6 Refit the mainshaft rear bearing without the shims.
- 7 Remove the differential side bearing outer race and shims, on the transmission side only.
- 8 Place the final drive assembly in position in the transmission case.
- 9 Fit the appropriate outer bearings to the mainshaft adjuster and differential side bearing adjuster.
- 10 Fit the adjusters in position, side bearing adjuster on the crownwheel, and mainshaft adjuster in the mainshaft bearing. Make sure the flat portion faces the crownwheel.
- 11 Fit the mainshaft to the mainshaft adjuster, fit the special dowel pins, and bolt on the transmission case, tightening the bolts to the same torque as for reassembly.
- 12 Using feeler gauges, measure the clearances between the mainshaft and side bearing adjusters.

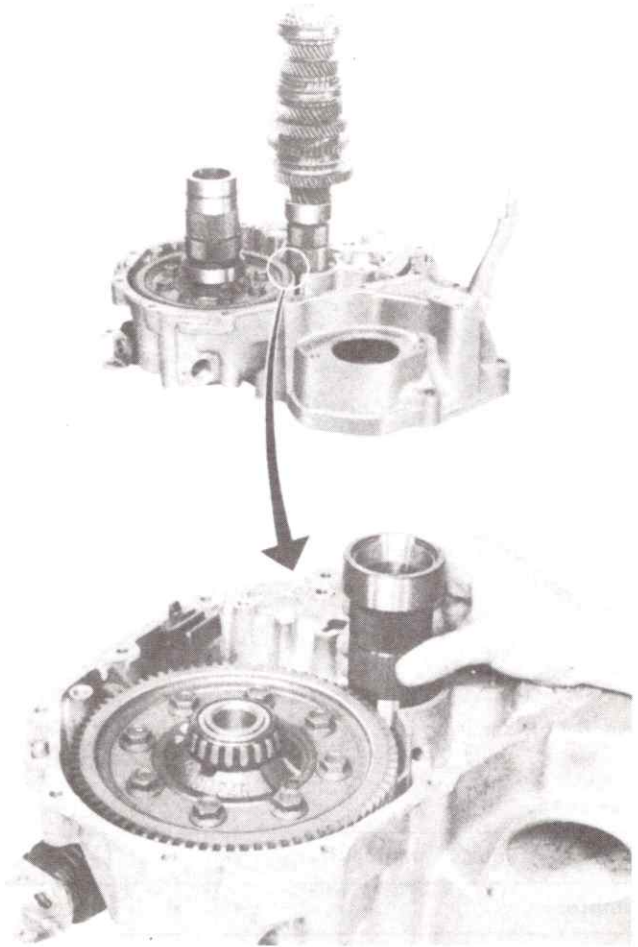


Fig. 6.15 Fitting the adjusters (make sure the flat portion faces the crownwheel) (Sec 9)

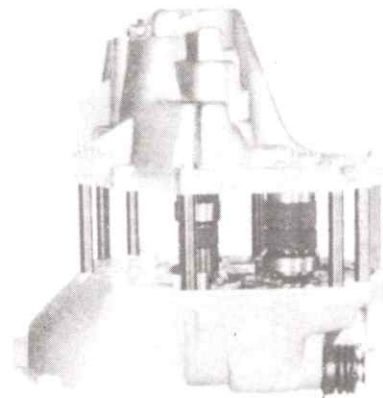


Fig. 6.16 The casings bolted together using the bearing adjusters and transmission case support collars (Sec 9)

13 Consult your dealer for suitable shims.

14 Remove the transmission case and the adjusters, then remove the mainshaft and side bearing outer races (transmission case side only).

15 Having selected the correct size shims, refit the bearings with the shims underneath them and reassemble the transmission unit as described in Section 8.

### Turning torque

16 As a check that the transmission has been assembled correctly, measure the torque required to turn firstly the final drive assembly, then the whole transmission (Fig. 6.18).

17 Check the figures obtained against those in the Specifications. Note that if the original bearings are used, the final torque figures will be slightly lower than those for new bearings.

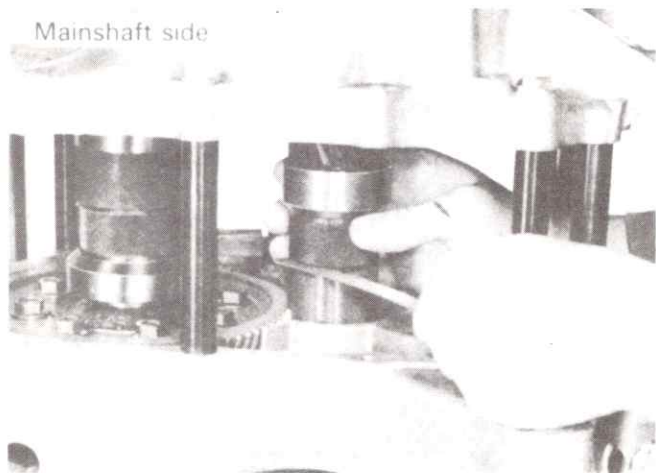


Fig. 6.17 Measuring clearance between mainshaft and side bearing adjusters (Sec 9)

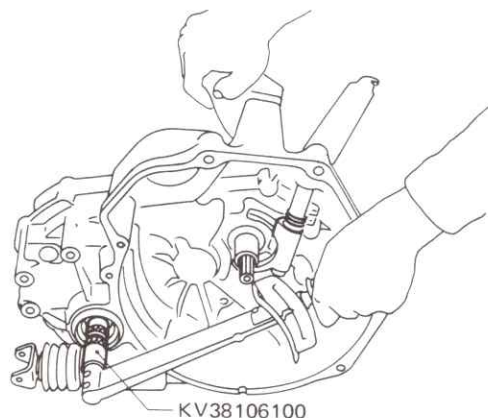


Fig. 6.18 Measuring turning torque (Sec 9)

## 10 Fault diagnosis – manual transmission

Symptom	Reason(s)
Weak or ineffective synchromesh	Synchro baulk rings worn, split or damaged Synchromesh units worn or damaged
Jumps out of gear	Gearchange mechanism worn Synchromesh units badly worn Selector fork badly worn
Excessive noise	Incorrect grade of oil in gearbox or oil level too low Gear teeth excessively worn or damaged Shaft thrust washers worn allowing excessive end play Worn bearings
Difficulty in engaging gears	Clutch pedal adjustment incorrect
Noise when cornering	Wheel bearing or driveshaft fault Differential fault

**Note:** It is sometimes difficult to decide whether it is worthwhile removing and dismantling the gearbox for a fault which may be nothing more than a minor irritant. Gearboxes which howl, or where the synchromesh can be beaten by a quick gearchange, may continue to perform for a long time in this state. A worn gearbox usually needs a complete rebuild to eliminate noise because the various gears, if re-aligned on new bearings, will continue to howl when different wearing surfaces are presented to each other. The decision to overhaul, therefore, must be considered with regard to time and money available, relative to the degree of noise or malfunction that the driver has to suffer.

# Chapter 7 Automatic transmission

For modifications, and information applicable to later models, see Supplement at end of manual

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Fluid level – checking, topping up and changing .....	3	Routine maintenance .....	2
General description .....	1	Speed selector cable – adjustment .....	5
Governor shaft – removal and refitting .....	9	Transmission – removal and refitting .....	11

## Specifications

Type .....	RL3F01B fully automatic, air-cooled, lock up design, providing three forward and one reverse gear
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### Ratios

1st .....	2.826:1
2nd .....	1.543:1
3rd .....	1.000:1
Reverse .....	2.364:1
Final drive .....	3.737:1

### Lubrication

Fluid capacity .....	10.6 Imp pts (6.0 litres)
Fluid type .....	Dexron II type ATF (Duckhams D-Matic)

Fluid capacity .....	10.6 Imp pt (6.0 litres)
----------------------	--------------------------

### Torque wrench settings

	lbf ft	kgf m
Driveplate to torque converter .....	29 to 36	4 to 5
Torque converter housing to engine .....	12 to 16	1.6 to 2.2
Sump pan bolts .....	3.6 to 5.1	0.5 to 0.7
Control valve body to transmission casing .....	5.1 to 6.5	0.7 to 0.9
Governor valve body to shaft .....	3.6 to 5.1	0.5 to 0.7

## 1 General description

The automatic transmission incorporates a torque converter with planetary geartrains and the final drive differential unit.

Six speed selector control lever positions are used as follows:

- P* Park – to lock the transmission
- R* Reverse gear
- N* Neutral

- D* Forward speed, changes automatically up and down between 1st, 2nd and 3rd gear
- 2* Second gear hold, will change only between 1st and 2nd gears
- 1* First gear, will hold the transmission in 1st gear

An automatic kickdown device is incorporated which allows for rapid acceleration during overtaking, or for hill climbing, actuated by fully depressing the accelerator.

The torque converter is air cooled.

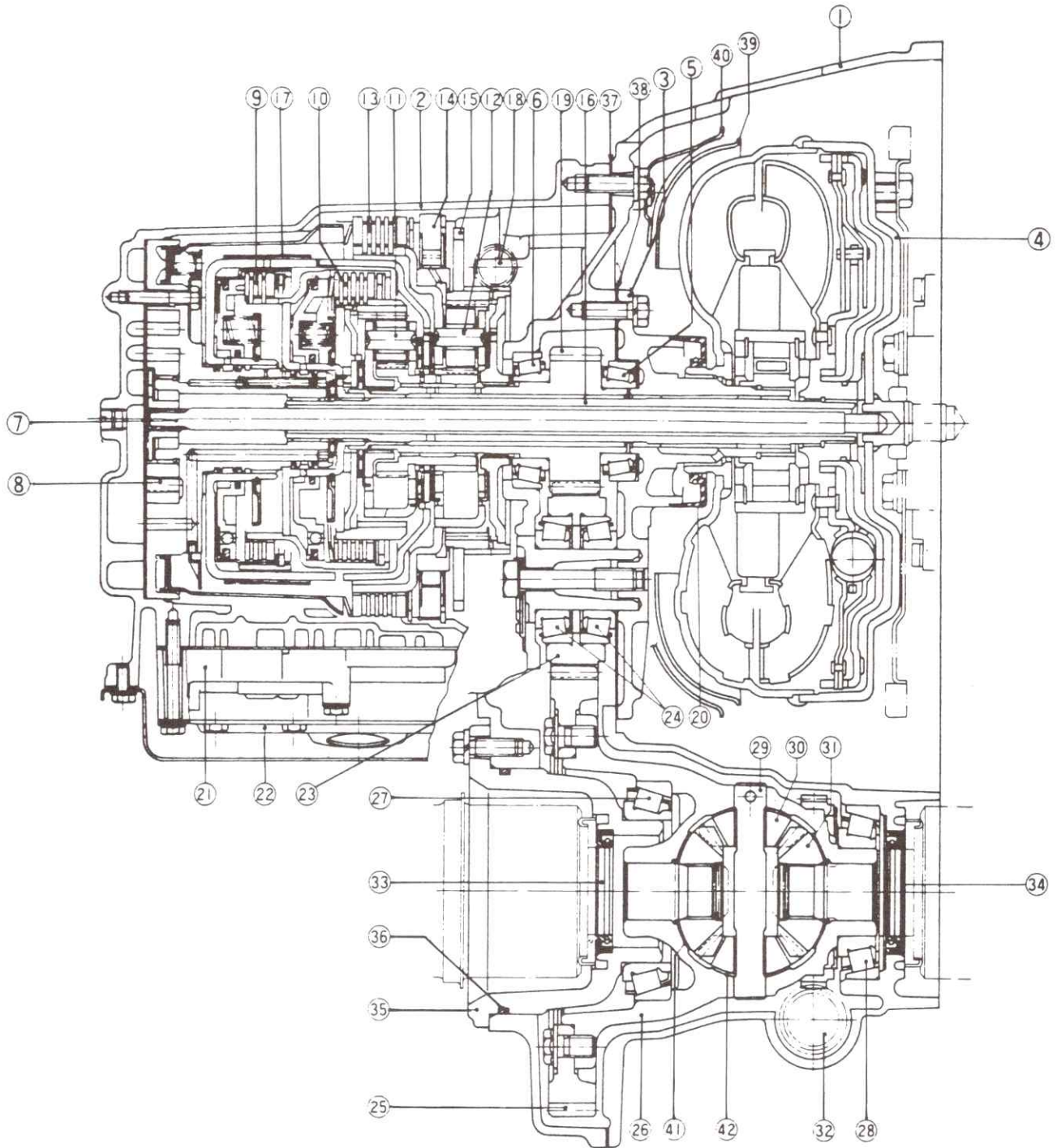


Fig. 7.1 Sectional view of automatic transmission (Sec 1)

- |                                     |                          |   |                                    |
|-------------------------------------|--------------------------|---|------------------------------------|
| 1 Torque converter housing          | 11 Front planetary gear  | 23 Idler gear                             | 32 Speedometer pinion gear         |
| 2 Transmission case                 | 12 Rear planetary gear   | 24 Idler gear taper roller bearing        | 33 Differential gear side oil seal |
| 3 Front cover                       | 13 Low and reverse brake | 25 Final gear                             | 34 Differential gear side oil seal |
| 4 Torque converter                  | 14 One-way clutch        | 26 Differential gear case                 | 35 Bearing retainer                |
| 5 Output shaft taper roller bearing | 15 Parking gear          | 27 Differential gear taper roller bearing | 36 O-ring                          |
| 6 Output shaft taper roller bearing | 16 Input shaft           | 28 Differential gear taper roller bearing | 37 Gasket                          |
| 7 Oil pump shaft                    | 17 Brake band            | 29 Pinion mate shaft                      | 38 Gasket                          |
| 8 Oil pump                          | 18 Governor valve shaft  | 30 Pinion mate gear                       | 39 Converter shroud                |
| 9 High-reverse clutch (Front)       | 19 Output shaft          | 31 Side gear                              | 40 Shroud separator                |
| 10 Forward clutch (Rear)            | 20 Front cover oil seal  |   | 41 Side gear thrust washer         |
|                                     | 21 Control valve         |   | 42 Pinion mate gear thrust washer  |
|                                     | 22 Oil strainer          |   |                                    |

## 2 Routine maintenance

- 1 Every week, or before a long journey, check the transmission fluid level. Visually inspect the fluid on the dipstick for discoloration due to contamination, which may indicate internal wear.
- 2 If the car is operating under severe conditions, renew the transmission fluid every 24 000 miles, (40 000 km) or two years, whichever comes first.

## 3 Fluid level – checking, topping up and changing

- 1 Check the fluid level at the intervals given in Section 2.
- 2 The precise level of the fluid will depend on the ambient temperature (see Fig. 7.2). First park the car on a level surface and apply the handbrake.
- 3 Run the engine for ten minutes and allow it to idle.
- 4 Move the selector lever slowly through each position ending in Park (P).
- 5 With the engine idling, withdraw the transmission dipstick, wipe it clean, re-insert it and then withdraw it again and read off the fluid level.
- 6 If it is not as indicated in the illustrations, top up. On no account overfill the automatic transmission or run it with too low a fluid level.
- 7 Renewal of the automatic transmission fluid is only specified by the manufacturers if the vehicle is operated under arduous conditions – such as trailer towing. However, it would seem to make sense to change the fluid on all vehicles after a reasonably high mileage in order to remove any impurities from the system. The additives in the fluid will almost certainly have lost some of their characteristics by this time as well.
- 8 Before draining the fluid, have it at normal operating temperature by running on the road for a distance of at least five miles (eight kilometres).
- 9 Unscrew and remove the transmission drain plug and catch the fluid in a container.
- 10 The condition of the fluid is an indication of the serviceability of the transmission. If it is very dark or nearly black and smells of burning, suspect worn friction components within the transmission. If there is no odour then the discolouration may be due to a small leak of coolant coming from the fluid cooler within the radiator.
- 11 If the fluid is an opaque pink in colour this will be due to a coolant leak or flood water contamination.
- 12 If the fluid is dark brown in colour and sticky, this will probably be due to overheating by under or over filling.
- 13 Refit the drain plug, withdraw the dipstick and pour the fresh fluid into the transmission through the dipstick guide tube.
- 14 Check the fluid level, as previously described.

## 4 Overhaul and adjustment – general

- 1 Owing to the need for special tools and equipment, operations to the automatic transmission should be limited to the in-vehicle work described in the following Sections.
- 2 Where more extensive overhaul is required, it is best to leave this to your dealer, or, where necessary, remove the transmission for professional repair or renewal, as described in Section 11.

## 5 Speed selector cable – adjustment

- 1 When the hand control lever is moved to all positions on the index, the individual detents should be positively felt. If this is not so, adjust in the following way.
- 2 Set the control lever to P.
- 3 Working at the selector lever on the transmission casing, disconnect the cable.
- 4 With the fingers, move the selector lever positively into its P detent.
- 5 Using the cable end fitting locknuts, adjust the cable until it applies no tension in either direction to the selector lever on the transmission. Tighten the locknuts.
- 6 Check that the selector positions are positively obtained.

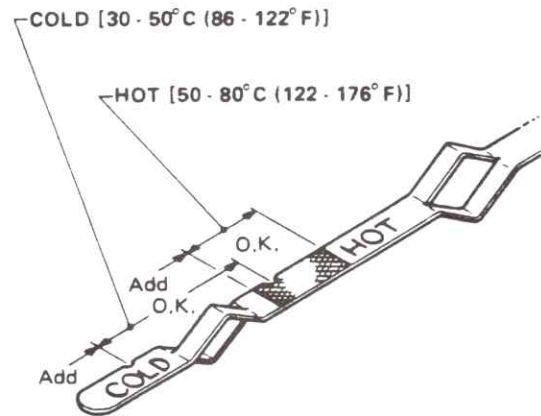


Fig. 7.2 Checking automatic transmission fluid level (Sec 3)

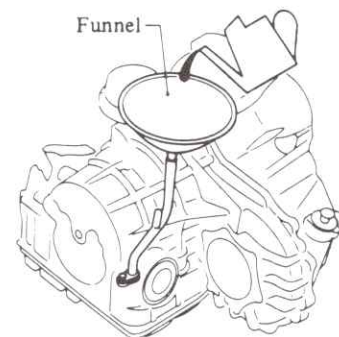


Fig. 7.3 Use a clean funnel to fill the automatic transmission (Sec 3)

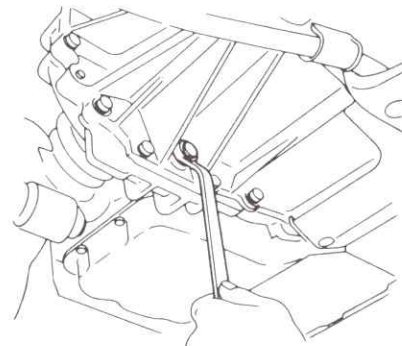


Fig. 7.4 The transmission drain plug (Sec 3)

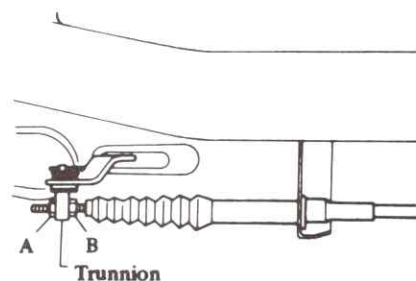


Fig. 7.5 Selector cable adjustment at transmission end (Sec 5)

A Locknut

B Locknut

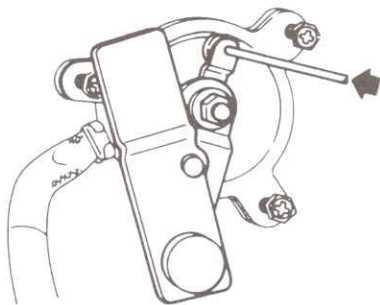


Fig. 7.6 Adjusting the inhibitor switch (Sec 6)

*Arrow indicates alignment pin*

## 6 Inhibitor switch – adjustment

- 1 The inhibitor switch controls the reversing lamps when R is selected, and also prevents operation of the starter when the hand control lever is in any position but P or N.
- 2 If the inhibitor switch does not operate correctly, adjust in the following way.
- 3 Loosen, but do not remove, the switch screws.
- 4 Set the hand control lever to N.
- 5 Push a 2.5 mm (0.098 in) diameter pin through the switch lever and switch body holes to align them. Hold the pin and tighten the switch screws. Remove the pin.

## 7 Kickdown cable – adjustment and renewal

- 1 Release the cable locknuts at the carburettor.
- 2 With the throttle cable pulley held in the full throttle position move the cable end fitting in the direction T (see Fig. 7.7). Tighten nut B to eliminate any free movement.
- 3 Unscrew nut B between one and one and a half turns and secure it in this position by tightening nut A (see Fig. 7.8).
- 4 Check that the throttle cable end fitting movement L is within the specified tolerances (see Fig. 7.9).
- 5 To renew the cable, first remove the fluid sump pan and control valve assembly, as described in the next Section.
- 6 Disconnect the kickdown cable from the carburettor.
- 7 Disconnect the other end of the cable from the lever and then release the cable conduit from the casing by flattening the lockplate tab and unscrew the nut.
- 8 Fit the new cable by reversing the removal operations. Bend up the locktab around the nut.
- 9 Adjust as previously described, and finally check that the rubber bellows (if fitted) on the inner cable at the carburettor end is not twisted.

## 8 Brake band – adjustment

- 1 This will normally only be required if a fault develops, indicated by one of the following symptoms.

*No change from 1st to 2nd  
Speed changes direct from 1st to 3rd  
Severe jerk on 1st to 2nd upshift  
Poor acceleration  
Maximum speed not obtained  
No 3rd to 2nd downshift  
No kickdown when in 3rd gear  
Slip in 3rd to 2nd downshift  
No manual 3rd to 2nd downshift  
Transmission overheats*

- 2 Drain the transmission fluid.
- 3 Remove the sump pan shield, the sump pan and the gasket from the transmission.

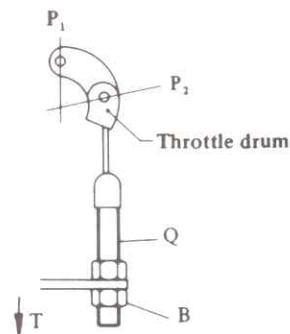


Fig. 7.7 Kickdown (throttle) cable end fitting at carburettor (Sec 7)

- |                           |                                 |
|---------------------------|---------------------------------|
| B Locknut                 | Q Cable end fitting             |
| P1 Full throttle position | T Adjustment movement direction |
| P2 Idle position          |                                 |

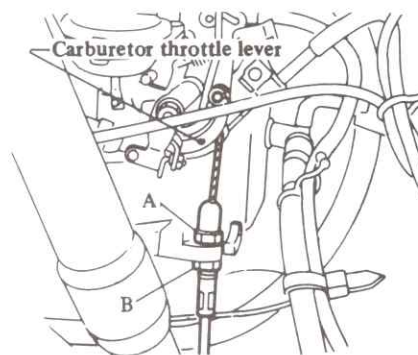


Fig. 7.8 Kickdown (throttle) cable locknuts A and B at carburettor end (Sec 7)

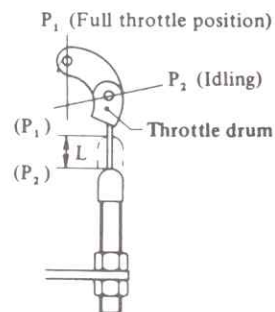


Fig. 7.9 Kickdown (throttle) cable movement diagram (Sec 7)

- |                                       |                           |
|---------------------------------------|---------------------------|
| L 1.079 to 1.236 in (27.4 to 31.4 mm) | P1 Full throttle position |
|                                       | P2 Idle position          |

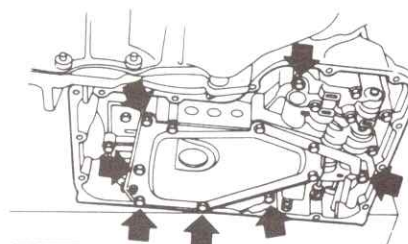


Fig. 7.10 Control valve assembly bolt locations (Sec 8)

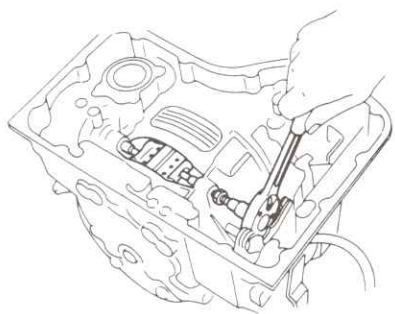


Fig. 7.11 Adjusting the brake band anchor pin (Sec 8)

- 4 Unscrew the bolts evenly and progressively and withdraw the control valve assembly.
- 5 Release the brake band anchor pin locknut and then, using a torque wrench, tighten the pin to between 4.0 and 6.0 Nm (3 and 4 lbf ft).
- 6 Now unscrew the anchor pin through 2½ complete turns. Hold the anchor pin stationary and tighten the locknut to between 16.0 and 22.0 Nm (12 and 16 lbf ft).

7 Refit the control valve assembly and tighten the bolts. Make sure that the manual and detent valves are correctly engaged – the manual valve should be set at neutral, and the groove on the detent valve should face forward.

8 Refit the sump pan together with a new gasket, followed by the shield. Fill the transmission with the specified fluid then check the level as described in Section 3.

### 9 Governor shaft – removal and refitting

- 1 On pre 1984 models disconnect the battery, remove the cooling system expansion tank, and remove the battery and its support bracket.
- 2 On 1984 on models remove the distributor cap.
- 3 Release the governor cap snap retainer, the cap with breather hose, and the sealing ring.
- 4 Unscrew the governor shaft lockbolt.
- 5 Withdraw the governor shaft.
- 6 The governor body may be unbolted from the shaft, and scratched or worn components renewed. The worm may be removed from the governor shaft after driving out the securing pin.
- 7 Refitting is a reversal of removal, but make sure that the cap is located on the case protrusion correctly.

### 10 Differential bearing oil seals – renewal

- 1 In the event of oil leakage from the differential bearing oil seals, it is necessary to ascertain whether the cause is simply worn oil seals or

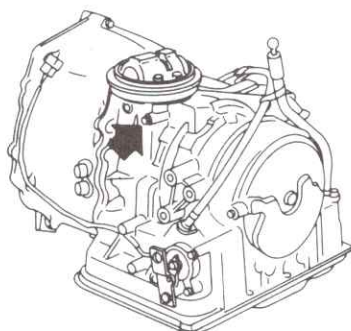


Fig. 7.12 Governor shaft lockbolt location (Sec 9)

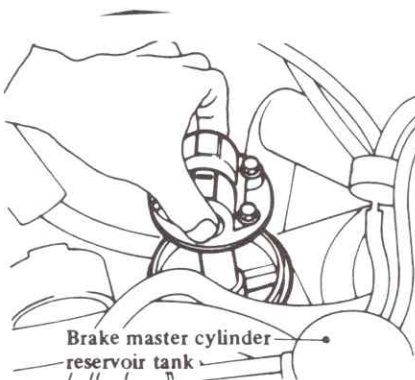


Fig. 7.13 Removing the governor shaft (Sec 9)

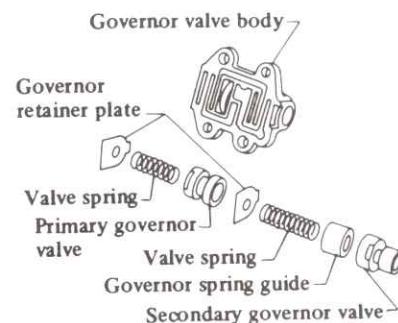


Fig. 7.14 Governor body components (Sec 9)

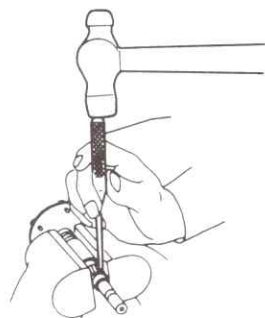


Fig. 7.15 Driving out the governor shaft worm pin (Sec 9)

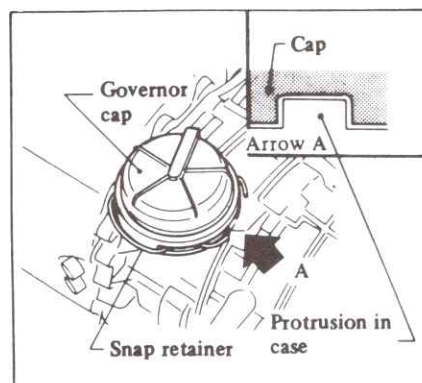


Fig. 7.16 Showing correct location of governor cap (Sec 9)

additionally, excessive wear of the side gears resulting in lateral movement in the oil seal. If the latter is the case, new oil seals will not necessarily cure the problem and the transmission should be renewed.

2 Jack up the front of the car and support on axle stands. Apply the handbrake.

3 Using a dial gauge at right angles to the driveshaft bellows clip

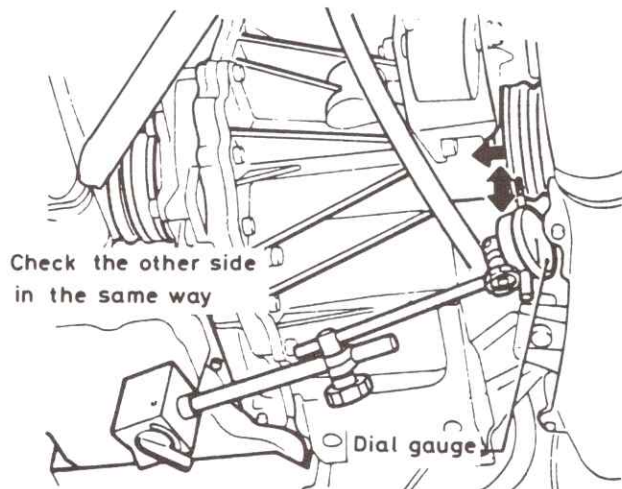


Fig. 7.17 Using a dial gauge to check the differential side gear wear (Sec 10)

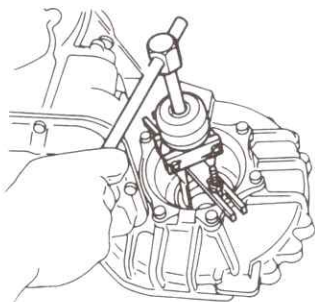


Fig. 7.18 Using a puller to remove a differential bearing oil seal (Sec 10)

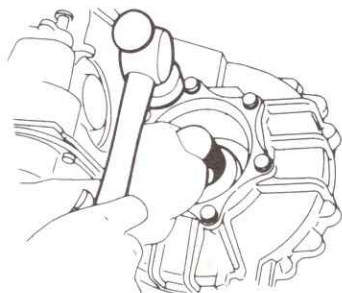


Fig. 7.19 Driving in a new differential bearing oil seal (Sec 10)

(Fig. 7.17), push the driveshaft joint fully towards the transmission then lightly move the joint up and down. If the play is more than 1.0 mm (0.039 in) the side gears are worn excessively, and renewal of the transmission should be considered.

4 If the side gear wear is not excessive remove the driveshafts as described in Chapter 8 and extract the oil seals using a two-legged puller.

5 Apply transmission fluid to the lips of the new oil seals before fitting them. A piece of tubing applied to the outer rim of the oil seal can then be used to drive them into their seats.

6 Refit the driveshafts with reference to Chapter 8.

## 11 Transmission – removal and refitting

1 Place the vehicle over an inspection pit or raise the front end and support it securely on axle stands positioned under the side-members.

2 Disconnect the battery.

3 Remove the left-hand roadwheel.

4 Drain the transmission fluid.

5 Remove the left-hand plastic wing shield.

6 Disconnect both driveshafts, as described in Chapter 6, Section 5, paragraphs 3 to 8.

7 Disconnect the speedometer cable from the transmission.

8 Disconnect the throttle cable from the carburettor and the leads from the inhibitor switch.

9 Disconnect the speed selector cable from the transmission lever, and the cable support bracket from the transmission casing.

10 Remove the dipstick guide/fluid filler tube.

11 Support the engine on a jack with a block of wood as an insulator.

12 Support the transmission on a second jack – preferably of trolley type.

13 Mark the relationship of the torque converter to the driveplate using a dab of quick-drying paint.

14 Unscrew the torque converter-to-driveplate connecting bolts. The crankshaft will have to be turned to bring each bolt into view within the cut-out of the torque converter housing before a spanner or socket wrench can be used.

15 Withdraw the automatic transmission flexible mounting pivot bolts.

16 Unbolt and remove the starter motor.

17 Unscrew and remove the torque converter housing-to-engine connecting bolts. Disconnect, plug and record the location of the coolant tube and mounting brackets held by some of these bolts. Unbolt the engine-to-transmission reinforcement strut.

18 Withdraw the transmission from under the front wing, having an assistant hold the torque converter in full engagement with the oil pump driveshaft to prevent loss of fluid.

19 If the transmission is being replaced with a new or rebuilt unit, check what is fitted to the new unit before parting with the original transmission. The parts not supplied can then be removed from the old unit.

20 Before offering up the transmission to the engine, check that the converter is pushed fully home. This can be determined if dimension A is not less than that specified (see Fig. 7.21).

21 Align the marks on the driveplate and torque converter (made before dismantling), apply thread locking fluid to clean bolt threads, and screw in and tighten the bolts to the specified torque.

22 Bolt on the starter motor.

23 Fit the engine-to-transmission connecting bolts, making sure to locate the coolant tube and mounting brackets under their correct bolts. Refit the mounting pivot bolts. Refit the reinforcement strut.

24 Reconnect the speed selector control cable, and adjust if necessary.

25 Reconnect the inhibitor switch leads.

26 Reconnect the fluid cooler hoses.

27 Refit the wing protective shield.

28 Refit the dipstick guide/fluid filler tube.

29 Reconnect the throttle cable.

30 Reconnect the speedometer drive cable.

31 Reconnect the driveshafts, as described in Chapter 8.

32 Refit the left-hand roadwheel.

33 Reconnect the battery.

34 Fill the transmission with the specified fluid then check the level as described in Section 3.

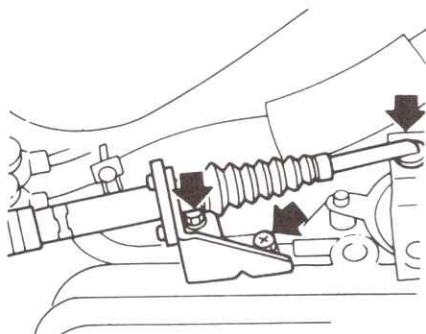


Fig. 7.20 Speed selector cable fixings at transmission end (Sec 11)

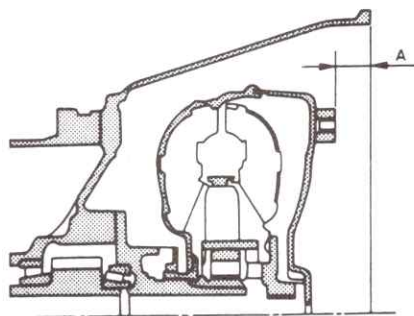


Fig. 7.21 Diagram showing torque converter dimension when fully installed (Sec 11)

*A = Not less than 21.1 mm (0.831 in)*

## 12 Fault diagnosis – automatic transmission

1 As has been mentioned elsewhere in this Chapter, no service repair work should be considered by anyone without the specialist knowledge and equipment required to undertake this work. This is also relevant to fault diagnosis. If a fault is evident, carry out the various adjustments previously described, and if the fault still exists consult the

local garage or specialist.

2 Before removing the automatic transmission for repair, make sure that the repairer does not require to perform diagnostic tests with the transmission installed.

3 Most minor faults will be due to incorrect fluid level, incorrectly adjusted selector control or throttle cables and the internal brake band being out of adjustment (refer to Sections 3, 5, 7 and 8).

# Chapter 8 Driveshafts

*For modifications, and information applicable to later models, see Supplement at end of manual*

## Contents

Driveshaft bellows – renewal .....	6	Fault diagnosis – driveshafts .....	7
Driveshaft – checking, removal and refitting .....	3	General description .....	1
Driveshaft inboard joint – removal and refitting .....	5	Routine maintenance .....	2
Driveshaft outboard joint – removal and refitting .....	4		

## Specifications

Type .....

Open shafts with ball and cage joints at each end

### Lubrication

Quantity of grease required for each driveshaft .....

90 g (3.17 oz)

Grease type .....

Lithium based molybdenum disulphide grease (Duckhams LBM 10)

### Torque wrench settings

Lower ball joint to arm .....

lbf ft

kgf m

Suspension strut to knuckle .....

36 to 43

5.0 to 6.0

Driveshaft nut .....

58 to 72

8.0 to 10.0

58 to 116

8.0 to 16.0

## 1 General description

The driveshafts are of the open type, transmitting power from the differential unit in the final drive assembly to the front roadwheels. Ball and cage joint are employed at both ends, but only the transmission side joint can be dismantled for repair, the roadwheel side being changed as a complete unit.

## 2 Routine maintenance

Every 12 000 miles (20 000 km) check the driveshaft rubber bellows for damage, cracks, leakage and security (photos). Where the car is operating under extreme conditions, reduce the service interval mileage by half or carry out the check every 6 months, whichever comes first.

## 3 Driveshaft – checking, removal and refitting

1 Jack up the front of the car and support on axle stands. Apply the handbrake.

2 Grip the driveshaft and attempt to turn it in alternate directions against the rotation of the roadwheel. If possible, have an assistant depress the brake pedal during the check. If any play is evident, the joint must be renewed (Section 4 or 5) or the complete driveshaft replaced.

3 To remove the driveshaft first remove the roadwheel.

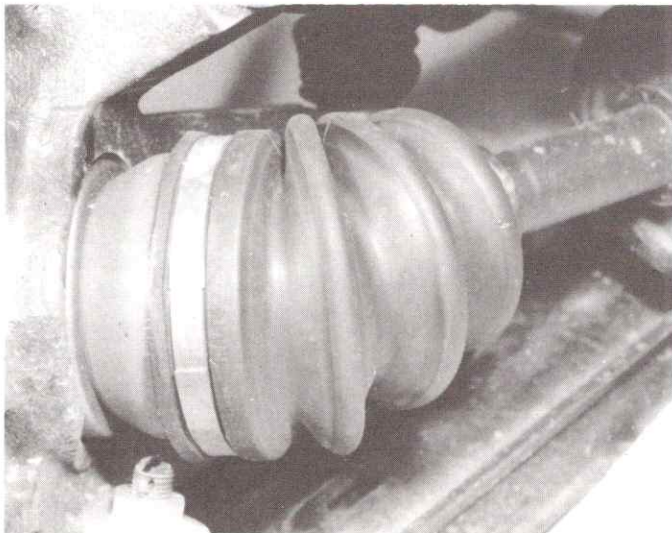
4 Extract the split pin, take off the nut retainer (photo), and loosen the driveshaft-to-hub retaining nut in order to hold the hub against rotation, either refit the roadwheel and lower the vehicle to the ground, have an assistant apply the brakes, or use a length of steel rod or bar

placed between two roadwheel studs as a lever. Take steps to prevent damage to the stud threads by screwing on the nuts.

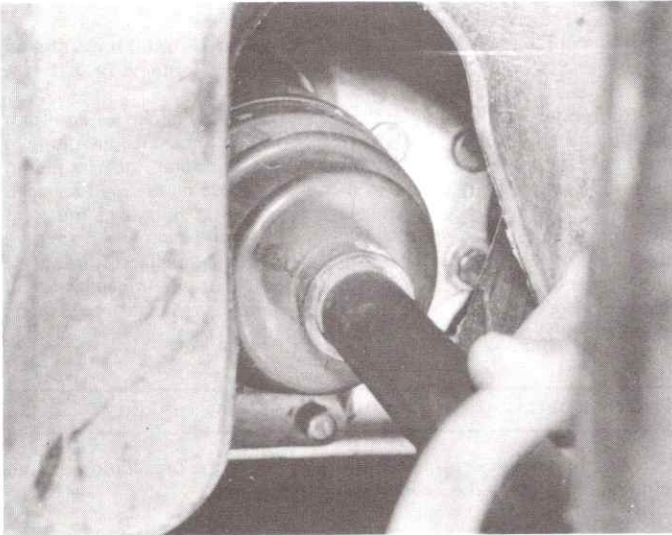
5 Unbolt the brake caliper and tie it up out of the way. There is no need to disconnect the hydraulic line. Remove the disc pads and pull the disc from the hub.

6 Extract the split pin, unscrew the nut, and detach the steering tie-rod from the steering knuckle using a separator tool.

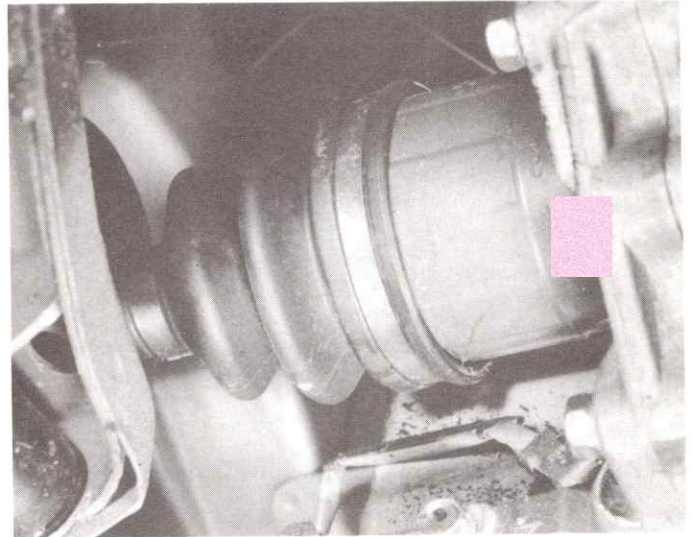
7 Disconnect the front suspension lower balljoint. Do this by unscrewing the nuts which hold the balljoint to the suspension arm. It is recommended that new nuts are used at reassembly.



2.1A Driveshaft outer rubber bellows



2.1B Driveshaft inner bellows (right-hand shaft)



2.1C Driveshaft inner bellows (left-hand shaft)

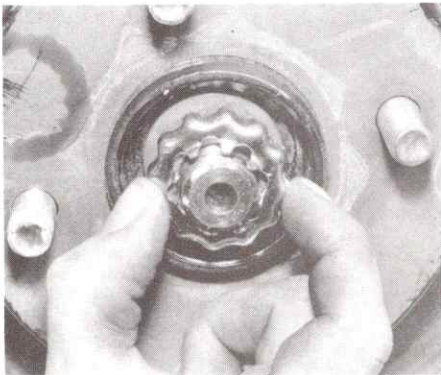
8 Place a suitable container beneath the transmission to catch any spilled oil.

9 Insert a large screwdriver or other lever between the transmission casing and the inboard joint flange of the driveshaft. On the right-hand side of the casing an aperture is provided for inserting the lever. Prise the joint to overcome resistance of the retaining clip (photo). Take care not to damage the transmission oil seal, and do not pull on the outer end of the driveshaft as the joints may come apart.

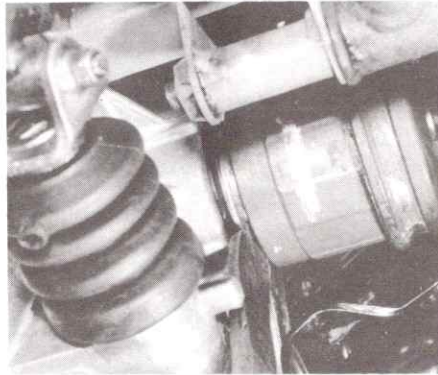
10 Unscrew and remove the bolts holding the knuckle to the strut, then withdraw the driveshaft from the transmission together with the hub and knuckle.

11 Once the inboard end of the shaft has been disconnected insert a short bar into the differential side gear as it is possible for the side gear to rotate and to fall into the differential case.

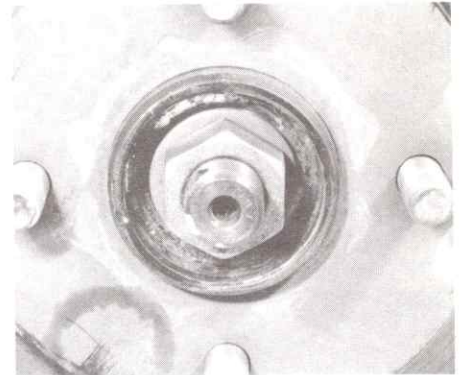
12 Working at the outboard end of the shaft, remove the driveshaft nut



3.4 Remove the split pin and nut retainer, and loosen the nut



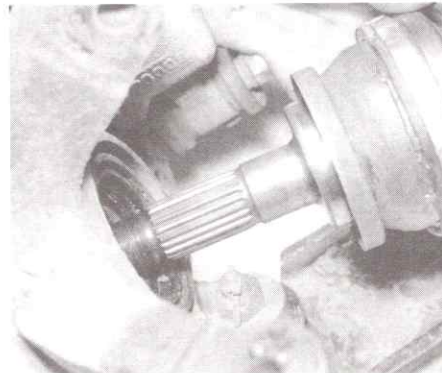
3.9 Prising free the driveshaft inboard joint



3.12A Removing the driveshaft nut ...



3.12B ... and washer



3.12C Withdrawing the outboard joint from the knuckle

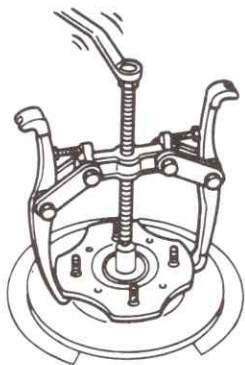


Fig. 8.1 Using a puller to push the driveshaft from the hub (Sec 3)

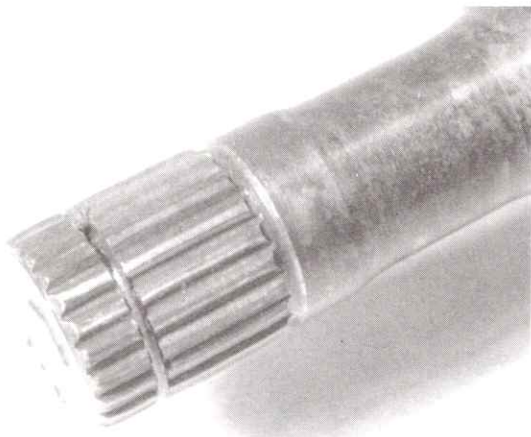
and washer and push the driveshaft out of the hub (photos). If it is tight, use a two or three-legged puller to push it out.

13 It is recommended that a new oil seal is fitted to the transmission whenever the driveshaft is removed. Refer to Chapter 6 or 7 for the procedure.

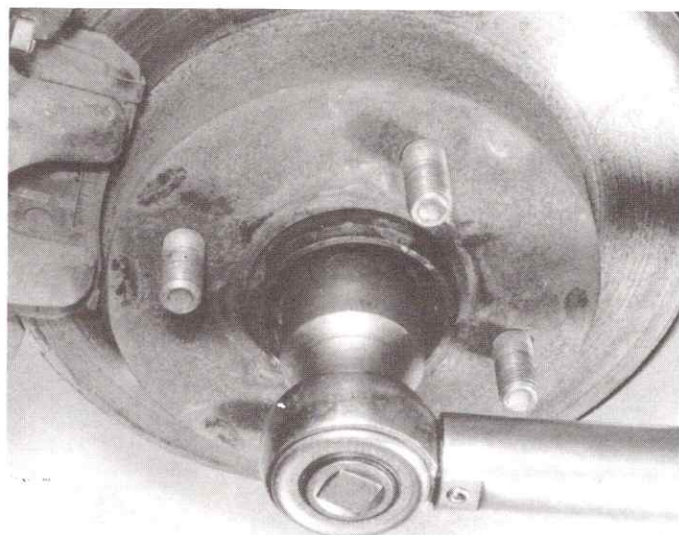
14 Refitting is a reversal of removal, but use a new circlip when fitting the inboard end of the driveshaft (photo). Push the shaft fully home in the side gear, after having first removed the temporary gear retaining bar and having applied grease to the oil seal lips. Pull the joint cover to check that the circlip is positively engaged. The flange of the joint casing may be tapped with a plastic-faced hammer if necessary to drive shaft fully home. Tighten all nuts and bolts to the specified torque and fit a new split pin to the hub nut (photos). Top up the transmission oil level as necessary, and finally depress the footbrake pedal several times to set the disc pads in their normal position.

#### 4 Driveshaft outboard joint – removal and refitting

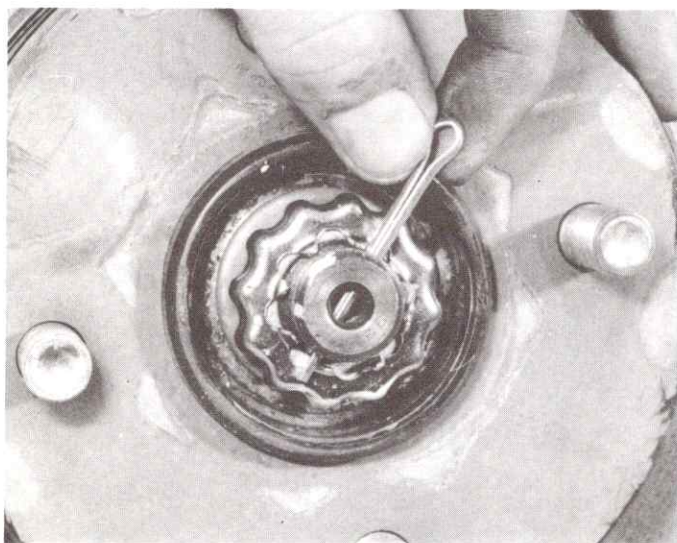
1 With the driveshaft removed, as described in the preceding Section, remove and discard the bellows securing bands.



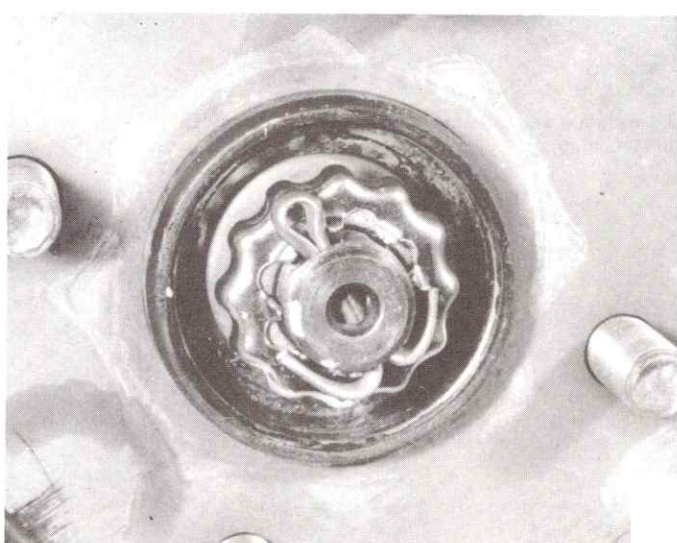
3.14A Circlip at driveshaft inboard end



3.14B Tightening the driveshaft nut



3.14C Insert a new split pin ...



3.14D ... and bend up the legs

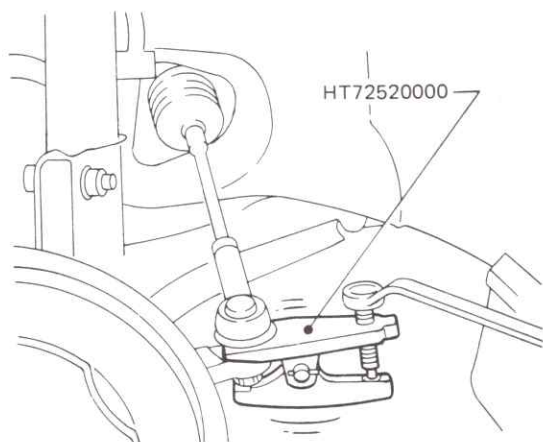


Fig. 8.2 Removing the steering rod to steering knuckle balljoint (Sec 3)

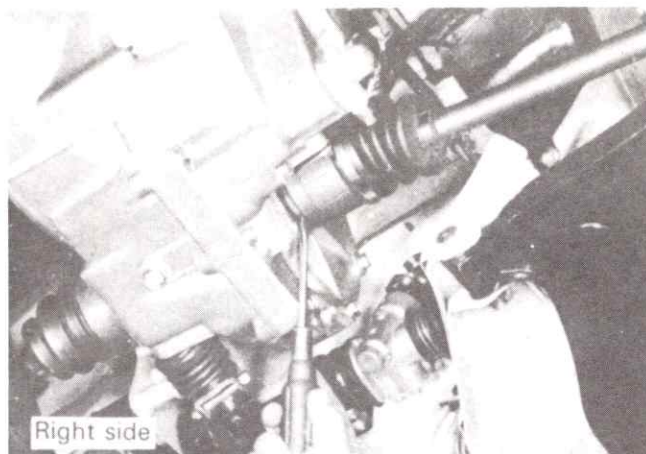


Fig. 8.3 Prising out the driveshaft from the transmission housing (Sec 3)

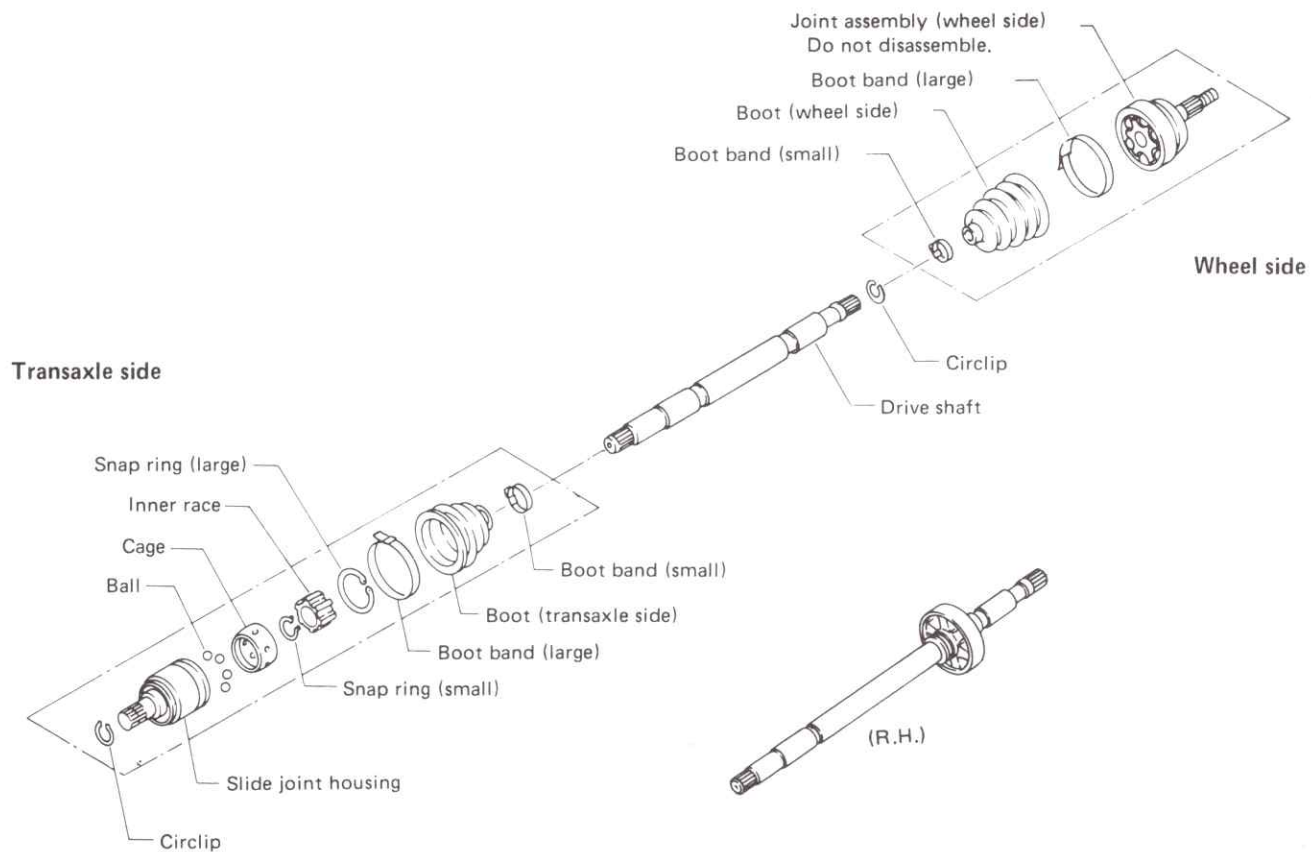
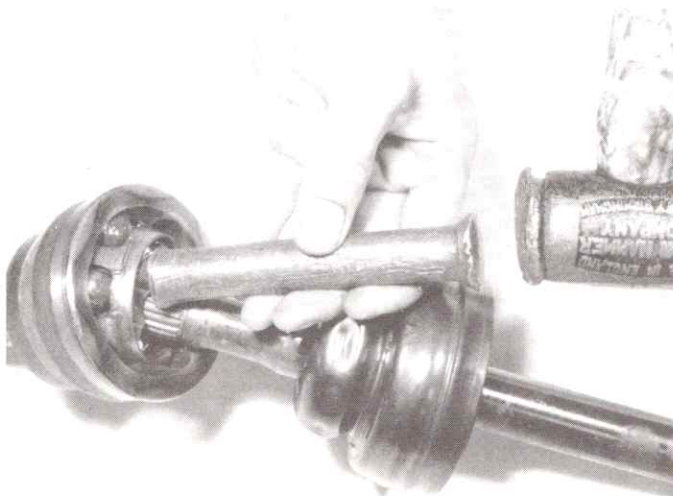


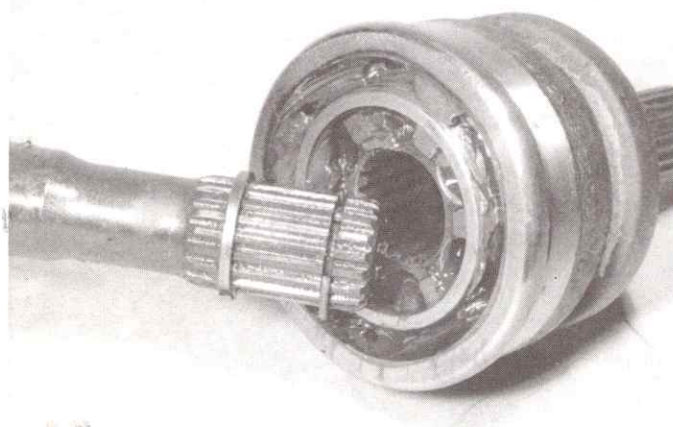
Fig. 8.4 Exploded view of the driveshaft (Secs 4 and 5)

*Some right-hand driveshafts are fitted with a damper*

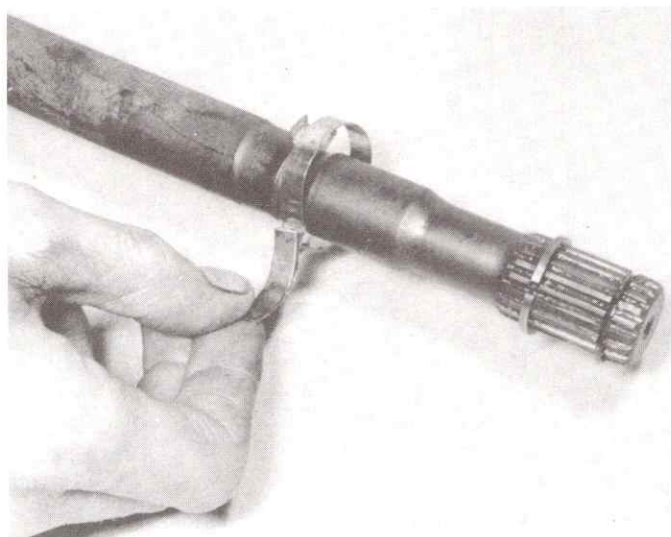


4.3 Removing the driveshaft outboard joint

- 2 Using quick-drying paint, put alignment marks on the shaft and joint.
- 3 Using a plastic or copper-faced hammer tap the outboard joint assembly off the shaft against the resistance of the retaining circlip (photo). Quite heavy blows will be required to release it.
- 4 Withdraw the flexible bellows from the shaft.
- 5 If the joint is worn it can only be renewed as an assembly.
- 6 Commence refitting by sliding the bellows onto the shaft and fitting a new securing band to the narrower diameter (photos).
- 7 If the original joint is being fitted, use a new retaining circlip and, having wiped away as much lubricant as possible, tap the joint onto the shaft until the circlip snaps home (photo). The marks made before removal should be in alignment.
- 8 Peel back the bellows and apply the specified quantity of the special grease which is supplied with each new joint. If the original joint is being refitted use a suitable molybdenum disulphide based grease (photo). See Specifications for quantity of grease required.
- 9 Set the bellows length (Fig. 8.5) then fit the large securing band. Tighten both bands using pliers and a screwdriver, bend over the tabs then bend back the remaining end and cut off the excess (photos).



4.7 Fitting the joint to the shaft



4.6A Slide on the small clip ...



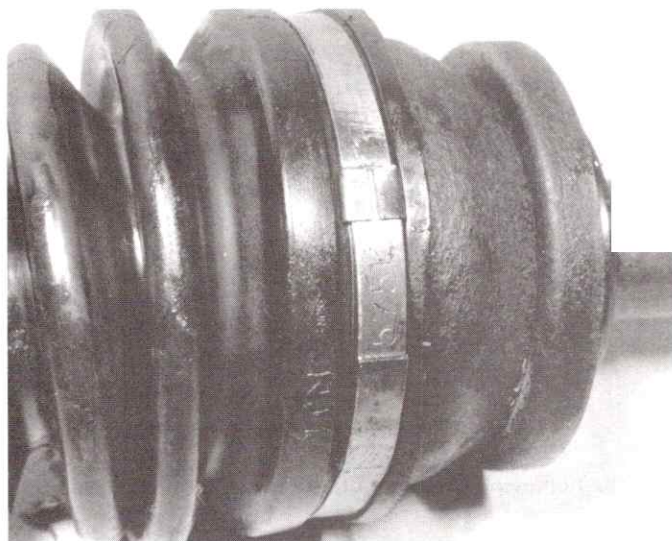
4.6B ... then the rubber bellows



4.8 Pack with grease



4.9A Fit the large clip ...



4.9B ... and bend over the tabs

### 5 Driveshaft inboard joint – removal and refitting

- 1 With the driveshaft gripped in the jaws of a vice fitted with jaw protectors, remove the bellows retaining bands and discard them.
- 2 Pull back the bellows and prise out the large circlip now exposed.
- 3 Pull off the slide joint housing.
- 4 Wipe away the grease from the ball cage and remove the balls.
- 5 Turn the cage through half a turn and pull it from the inner race.
- 6 Extract the circlip and tap the inner race from the driveshaft.
- 7 Pull the bellows from the driveshaft.
- 8 Refitting is a reversal of removal, but fit new circlips and pack the

joint with new grease. New joints are supplied with a grease pack, but if the original joint is being refitted use a suitable molybdenum disulphide grease. See Specifications for quantity of grease required.

- 9 Set the bellows length (Fig. 8.6) then fit the large securing band. Tighten both bands using pliers and a screwdriver, bend over the tabs, then bend back the remaining end and cut off the excess.

### 6 Driveshaft bellows – renewal

Renewal of either driveshaft bellows is only possible after removal of the relevant joint as described in Section 4 or 5.

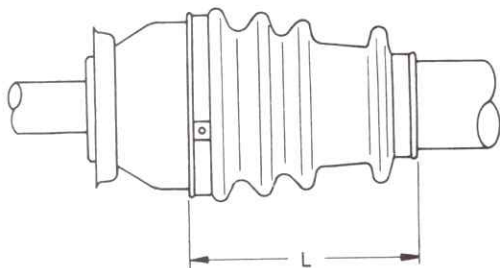


Fig. 8.5 Setting bellows length, outboard joint  
(Sec 4)

*Length L = 3.35 in (85 mm)*

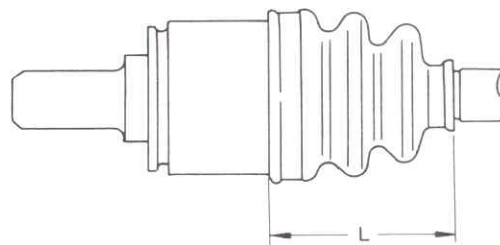


Fig. 8.6 Setting bellows length, inboard joint  
(Sec 5)

*Length L = 3.23 in (82 mm)*

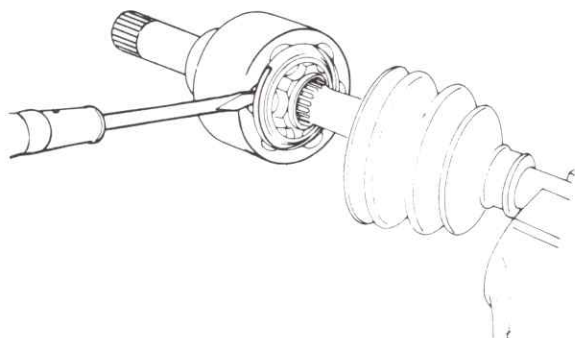


Fig. 8.7 Removing the circlip from an inboard joint (Sec 5)

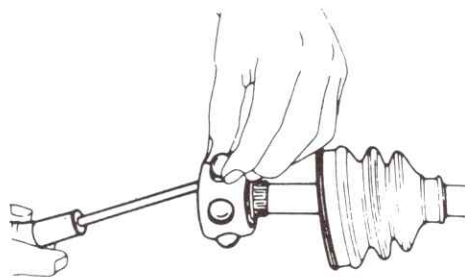


Fig. 8.8 Removing the balls from the joint (Sec 5)

## 7 Fault diagnosis – driveshafts

### Symptom

### Reason(s)

Vibration

Worn joints  
Worn wheel or differential bearings

Noise on taking up drive

Worn driveshaft splines  
Worn joints  
Loose driveshaft nut

# Chapter 9 Braking system

For modifications, and information applicable to later models, see Supplement at end of manual

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Brake drum – inspection and renovation .....	8	Hydraulic systems – bleeding .....	13
Brake pedal – removal, refitting and adjustment .....	18	Master cylinder – removal, overhaul and refitting .....	9
Caliper – removal, overhaul and refitting .....	5	Pressure regulating valve – general .....	10
Disc – inspection and renovation .....	6	Pressure regulating valve – testing .....	11
Disc pads – inspection and renewal .....	3	Rear brake linings – inspection and renewal .....	4
Fault diagnosis – braking system .....	19	Rear wheel cylinder – removal, overhaul and refitting .....	7
General description .....	1	Routine maintenance .....	2
Handbrake – adjustment .....	16	Vacuum servo unit – description and maintenance .....	14
Handbrake cables – renewal .....	17	Vacuum servo unit – removal and refitting .....	15
Hydraulic pipes and hoses – general .....	12		

## Specifications

<b>System type</b> .....	Front disc, rear drum, servo-assisted. Diagonally split hydraulic circuit, with proportioning valve. Automatic adjustment. Cable operated handbrake, acting on rear wheels	
<b>Brake fluid type/specification</b> .....	Hydraulic fluid to DOT 3 (Duckhams Universal Brake and Clutch Fluid)	
<b>Front brake discs</b>		
Diameter .....	214.0 mm (8.43 in)	
Maximum run-out .....	0.07 mm (0.0028 in)	
Minimum thickness of disc .....	10.0 mm (0.394 in)	
<b>Pad friction material minimum thickness</b> .....	2.0 mm (0.079 in)	
<b>Rear brakes</b>		
Drum inner diameter .....	180.0 mm (7.09 in)	
Drum maximum inner diameter .....	181.0 mm (7.13 in)	
Drum maximum run-out .....	0.05 mm (0.002 in)	
<b>Shoe friction material minimum thickness</b> .....	1.5 mm (0.059 in)	
<b>Brake pedal</b>		
Free height:		
Manual transmission .....	203.0 to 213.0 mm (7.99 to 8.39 in)	
Automatic transmission .....	205.0 to 215.0 mm (8.07 to 8.46 in)	
Stop lamp switch clearance .....	0 to 1.0 mm (0 to 0.04 in)	
Depressed height (engine running, force of 110 lb/50 kg) .....	At least 105 mm (4.13 in)	
<b>Torque wrench settings</b>	<b>lbf ft</b>	<b>kgf m</b>
Pedal bracket to body .....	5.8 to 8.0	0.8 to 1.1
Servo unit to pedal bracket .....	5.8 to 8.0	0.8 to 1.1
Master cylinder to servo unit .....	5.8 to 8.0	0.8 to 1.1
Servo unit input rod locknut .....	12 to 16	1.6 to 2.2
Stop lamp switch locknut .....	9 to 11	1.2 to 1.5
Pressure regulating valve mounting bolt .....	2.9 to 3.6	0.4 to 0.5
Air bleed valves .....	5.1 to 6.5	0.7 to 0.9
Brake tube flare nut .....	11 to 13	1.5 to 1.8
Brake caliper lockpin bolts .....	29 to 36	4.0 to 5.0
Drum brake back plate bolts .....	25 to 33	3.4 to 4.6
Wheel cylinder to back plate .....	4.3 to 5.8	0.6 to 0.8

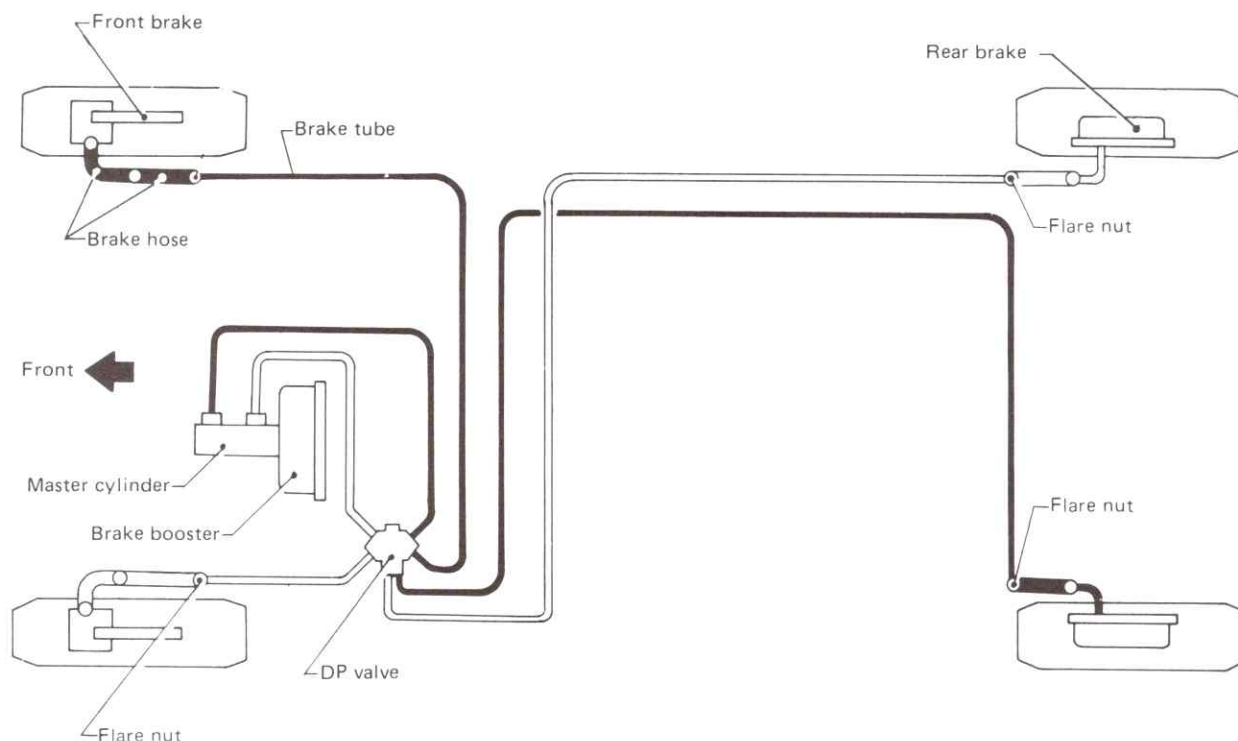


Fig. 9.1 Circuit diagram of the braking system (Sec 1)

### 1 General description

The braking system is of dual-line four wheel hydraulic type with servo assistance. The hydraulic circuit is split diagonally.

A pressure regulating valve is incorporated in the hydraulic circuit to prevent the rear wheels locking up during heavy applications of the brake pedal.

The handbrake operates mechanically on the rear wheels and incorporates an 'on' warning lamp switch.

### 2 Routine maintenance

1 Every 6000 miles (10 000 km) or 6 months whichever comes first, check the front brake disc pads for wear and check the condition and security of the discs, calipers and all hydraulic hoses and lines. Check the footbrake pedal and handbrake for wear and correct adjustment. Check that the brake fluid level in the reservoir is at or near the maximum mark, and top up if necessary. Slight variations of level will occur according to the wear of the brake linings, however if the level drops considerably the complete hydraulic system should be checked for leaks.

2 Every 12 000 miles (20 000 km) or 12 months whichever comes first, check the rear brake shoes and drums for wear.

3 Every 24 000 miles (40 000 km) or 24 months, whichever comes first, renew the brake fluid. Check the servo vacuum hoses, connections and non-return valve for operation, condition and security. If necessary, renew the servo air filter.

4 Every 24 000 miles (40 000 km) or 24 months whichever comes first, check the servo unit, hoses and check valve for operation, condition and security. If necessary renew the servo air filter.

### 3 Disc pads – inspection and renewal

1 Raise the front of the vehicle, support it securely, and remove the roadwheels.



Fig. 9.2 Hydraulic fluid reservoir (Sec 2)

2 Check the thickness of the friction material. This must not be less than that specified.

3 If the thickness is less than that figure the pads must be renewed as an axle set (four pads).

4 Unscrew and remove the caliper lockpin bolts (photo).

5 Remove the caliper and tie it up out of the way (photo).

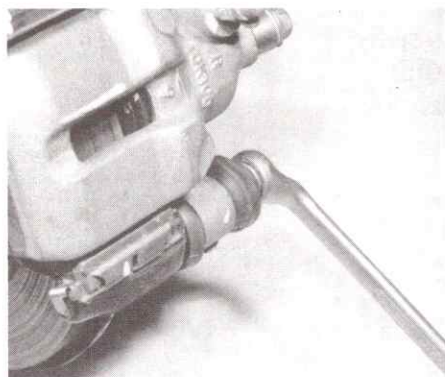
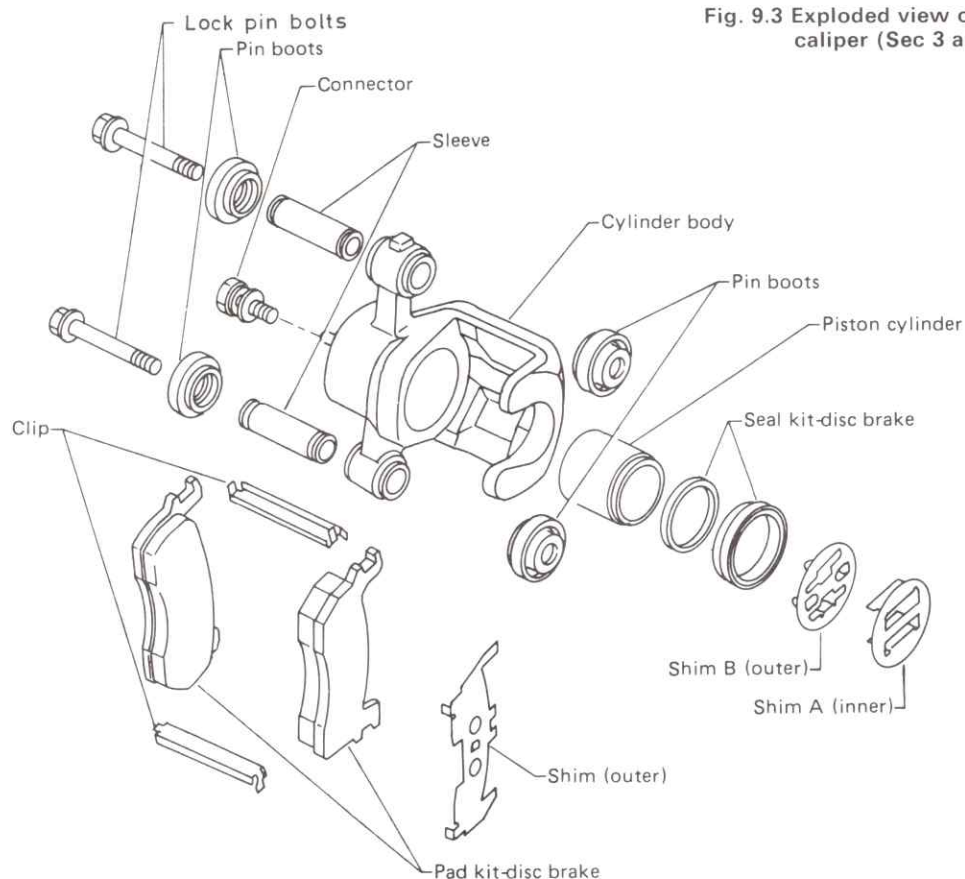
6 Note that, on some models, the caliper will pivot around the upper lockpin bolt, so it need not be removed.

7 Take out the pads (photo).

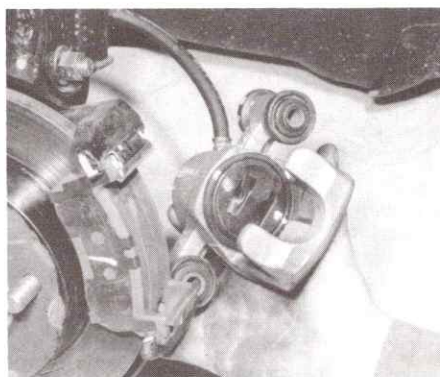
8 The retaining springs can be prised out, if required (photo), also the piston shim (photo).

9 Brush away dirt and dust. *Avoid inhaling it as it is injurious to health.* Do not depress the brake pedal while the pads are out of the caliper.

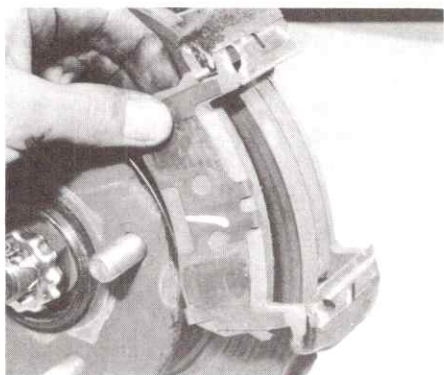
Fig. 9.3 Exploded view of front brake caliper (Sec 3 and 5)



3.4 Unscrewing the caliper lower lockpin bolt



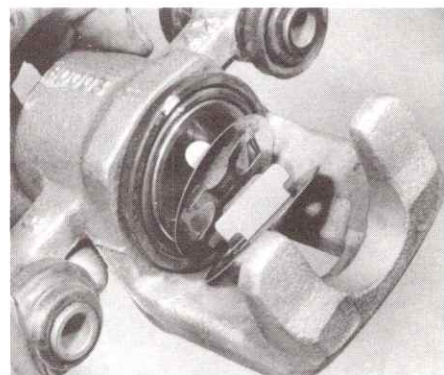
3.5 Removing the caliper to gain access to the disc pads



3.7 Removing the disc pads



3.8A Removing the pad retaining spring ...



3.8B ... and piston shims

10 Smear a trace of high melting-point grease onto the pad backplates and then locate the pads (friction surface to disc) and the anti-squeal shim.

11 The piston must now be fully depressed into the cylinder in order to accommodate the increased thickness of the new pads. Depressing the piston will cause the fluid level to rise in the master cylinder reservoir, so anticipate this by syphoning out some fluid using a clean battery hydrometer or meat baster.

12 Refit the caliper, or swivel it down, and secure with the lockpin bolt(s). Tighten both lockpin bolts to the specified torque.

13 Renew the pads on the opposite side, refit the roadwheels and lower the vehicle.

14 Apply the brakes hard to position the pads against the disc.

15 Check the fluid level, and top up the reservoir if necessary.

#### 4 Rear brake linings – inspection and renewal

1 Chock the front wheels. Raise the rear of the vehicle, support it securely and remove the roadwheels. Release the handbrake.

2 Prise off the hub grease cap, extract the cotter pin, take off the nut retainer and unscrew and remove the nut.

3 Pull off the brake drum, catching the outboard bearing which will be displaced. It is possible for the brake drum to be held on the axle due to the brake shoes being locked in grooves which have been worn in the drum. Should this occur, prise the plug from the brake backplate

and, using a screwdriver, lift the toggle lever from the automatic adjuster star wheel and turn the star wheel to contract the shoes.

4 Inspect the shoe linings. If their thickness is less than that specified the shoes must be renewed as an axle set (four shoes).

5 It is recommended that new shoes are purchased complete with linings. Attempting to reline old shoes yourself seldom proves satisfactory.

6 If the old shoes appear oil stained, this will be due to a leaking wheel cylinder (defective seal) or to a faulty bearing oil seal.

7 Remove the shoe steady springs. To do this, grip the edges of the spring cup with a pair of pliers (photo), depress it against pressure of the coil spring and turn it through 90°. Release the spring cup and take off the spring (photo).

8 Note the location of the shoes on the backplate with respect to the leading and trailing ends, as the lining material does not cover both ends of the shoes equally. Also note the spring location points on the shoes.

9 Prise off the shoe return spring clip (photo), and then release the shoe return spring. This is a U-shaped spring and one arm should be gripped and levered towards the other arm to release it from the hole in the shoe (photos). It is recommended that a rag is placed over the spring to prevent it flying out accidentally.

10 Pull the upper ends of the shoes apart and remove the adjuster strut (photo).

11 Unhook and remove the lower return spring and at the same time remove the shoes (photo). As they come away, disconnect the handbrake cable. Do not depress the brake pedal while the shoes are removed.

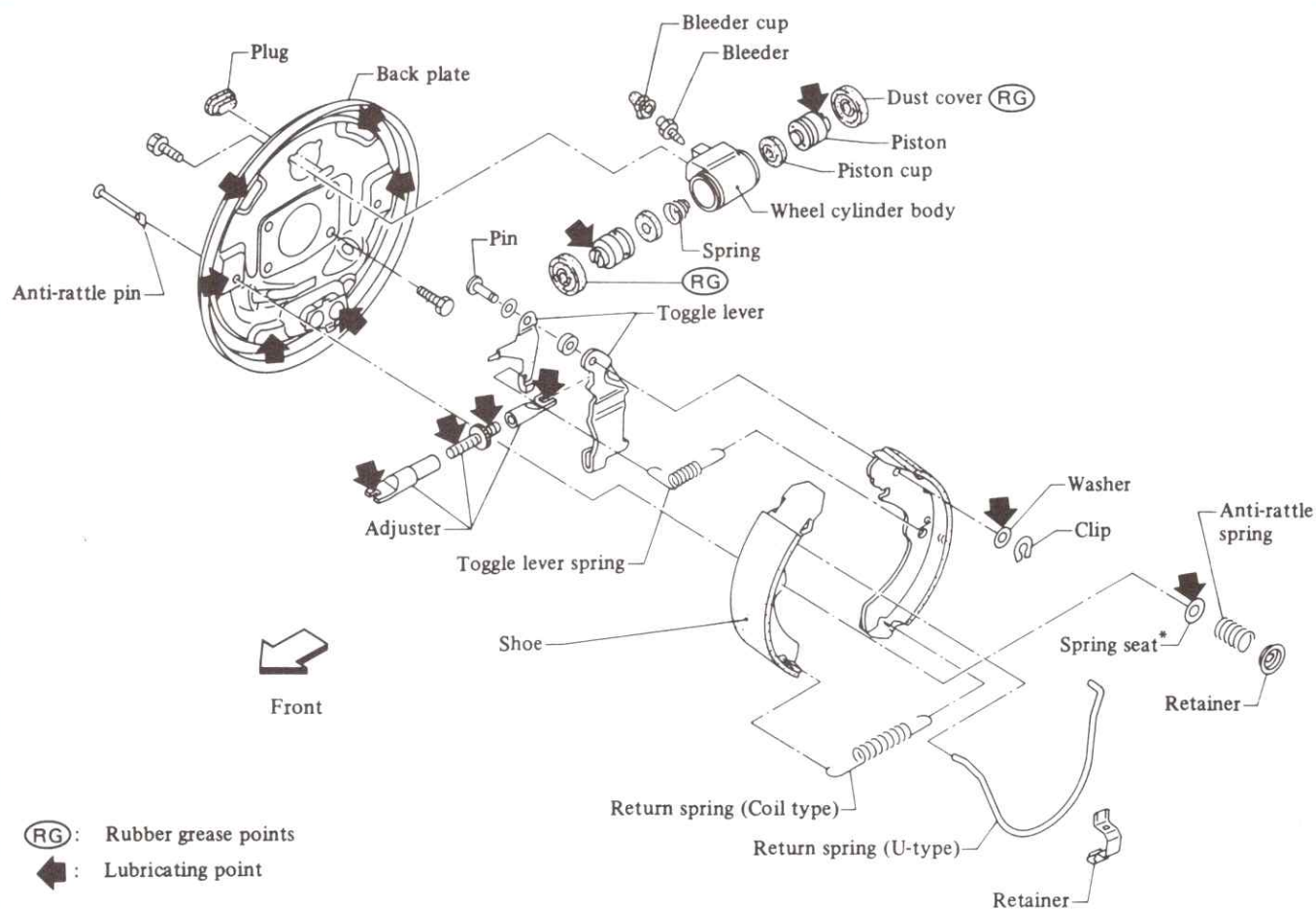
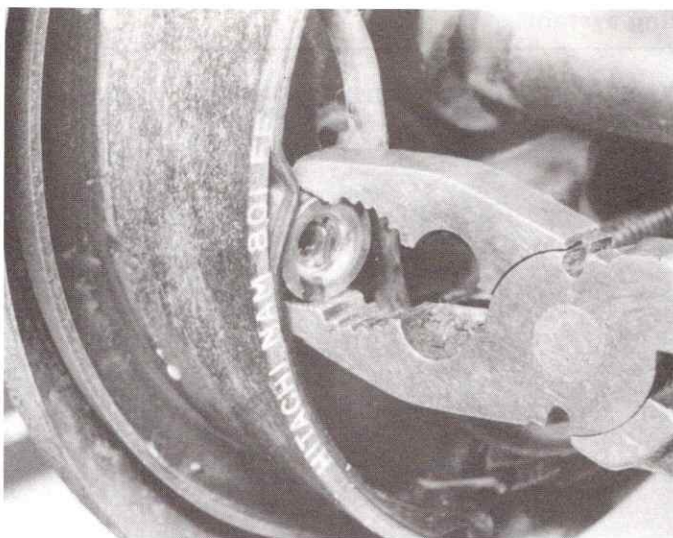
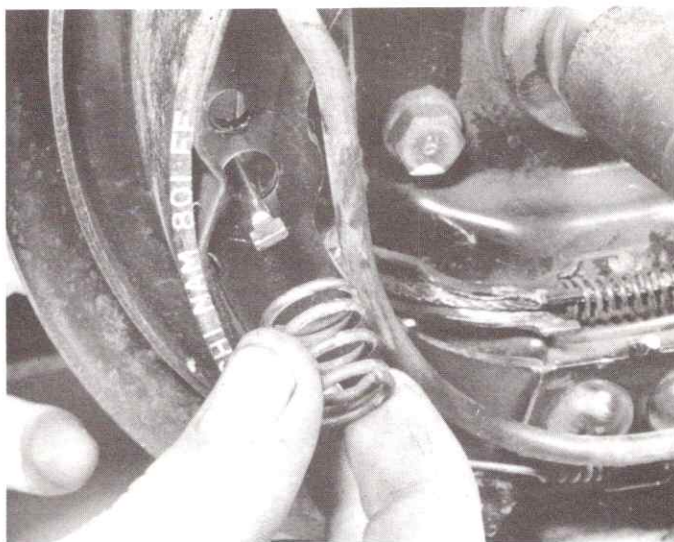


Fig. 9.4 Exploded view of rear brake (Sec 4)

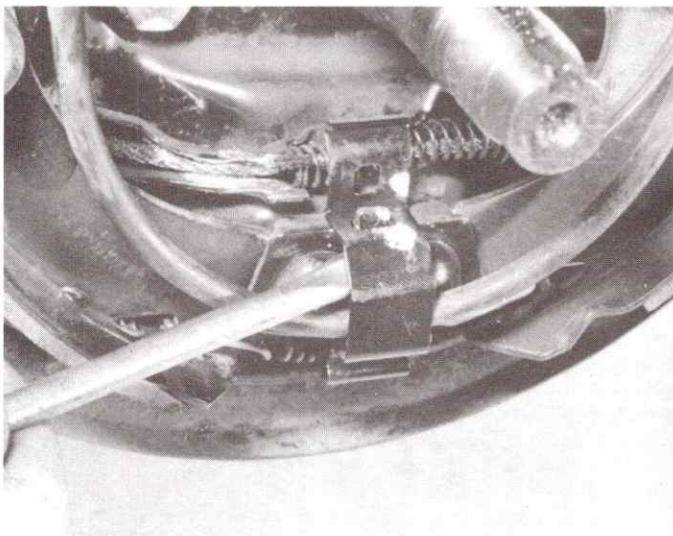
\* Deleted after 1985



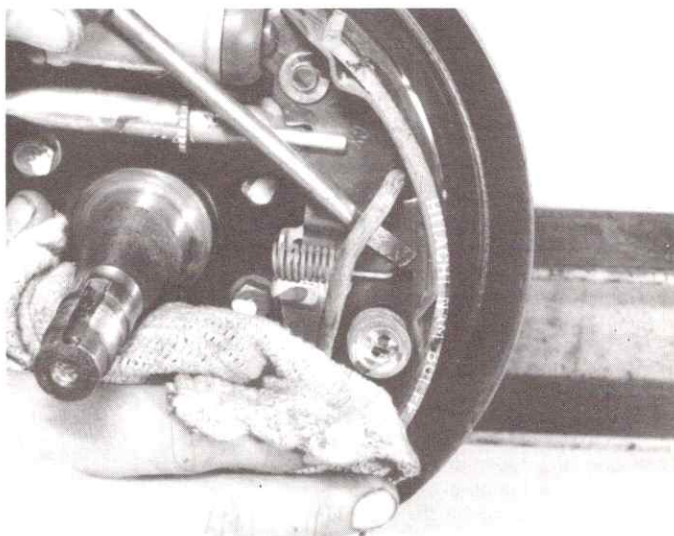
4.7A Removing a shoe steady spring cap ...



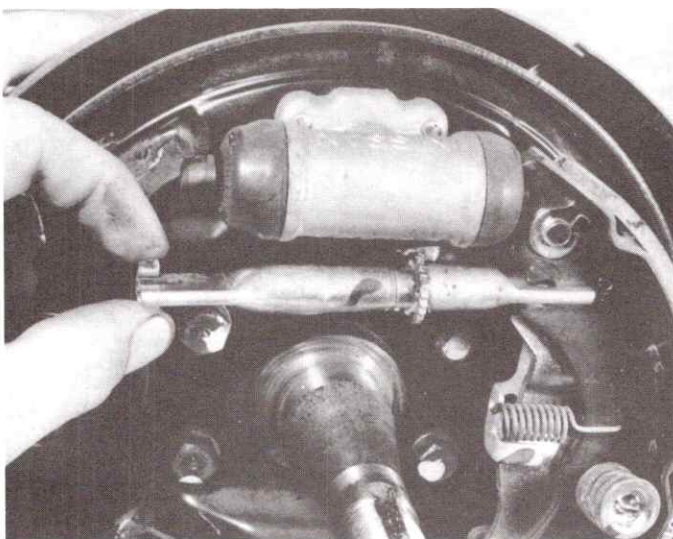
4.7B ... and spring



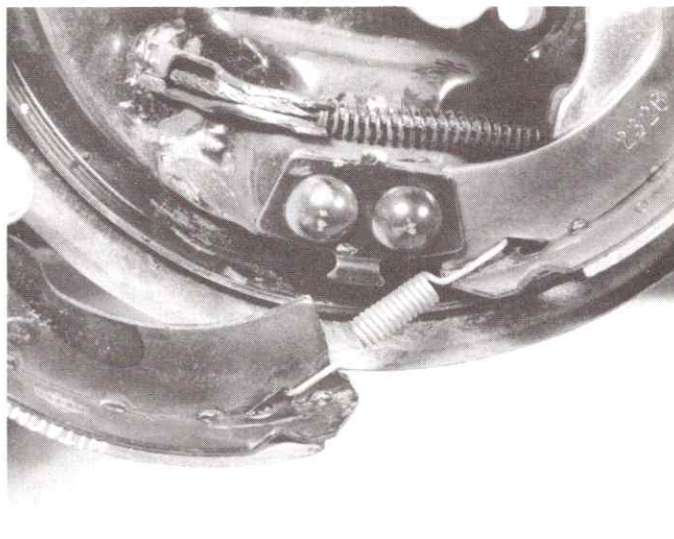
4.9A Prise off the spring clip ...



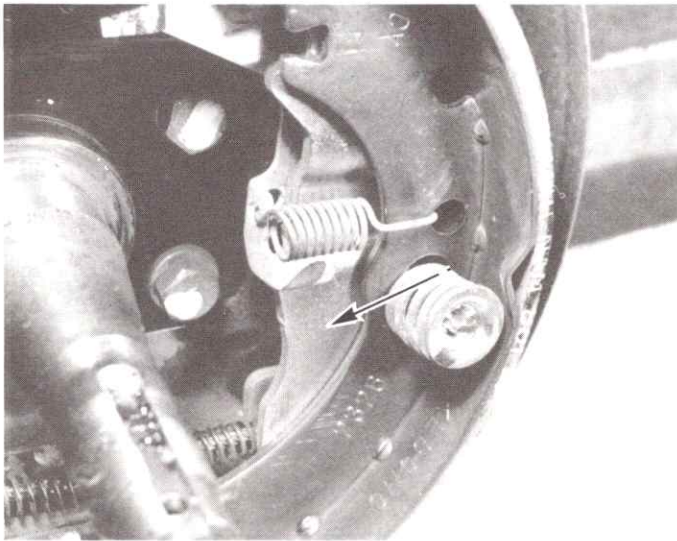
4.9B ... followed by the shoe return spring



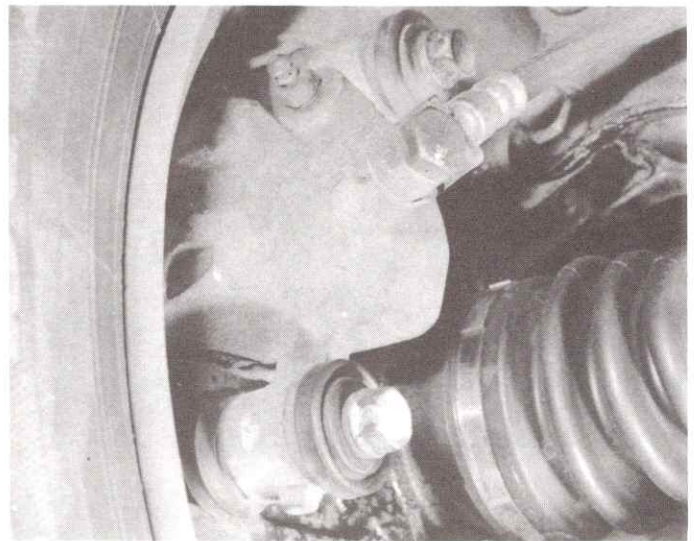
4.10 Removing the adjuster strut



4.11 Releasing the lower return spring when removing the brake shoes



4.12 Showing the handbrake and automatic adjuster toggle lever and spring



5.2A Front brake caliper viewed from inside

12 The handbrake and automatic adjuster toggle levers (photo) must be removed from the old shoe and fitted to the new one using the pin, washer, spring and U-shaped clip.

13 Apply a smear of grease to the shoe contact high spots on the brake backplate and to the ends of the wheel cylinder pistons.

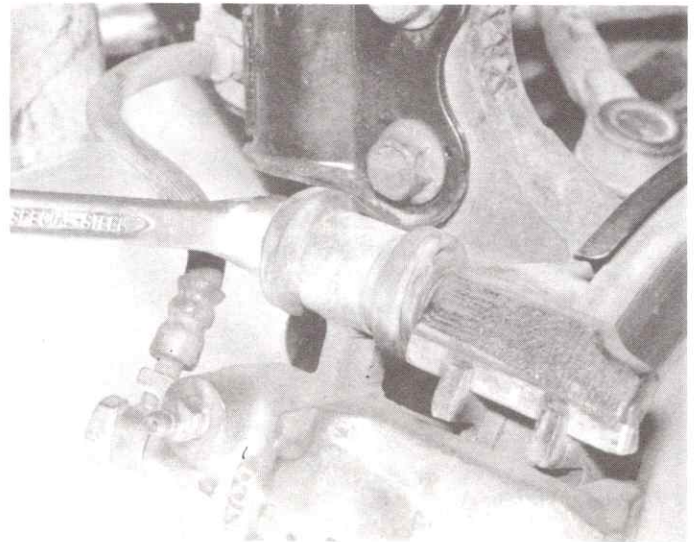
14 Fit the new shoes by reversing the removal operations, but before fitting the automatic adjuster strut turn the star wheel to contact the strut fully.

15 Refit the brake drum and adjust the bearing preload, as described in Chapter 10.

16 Repeat the operations on the opposite brake.

17 Apply the handbrake several times to actuate the automatic adjuster and to position the shoe linings as close as possible to the drum.

18 Refit the roadwheels and lower the vehicle.



5.2B Removing the lock pin bolts

## 5 Caliper – removal, overhaul and refitting

1 Raise the front of the vehicle and support it securely. Remove the roadwheel. Fit a suitable clamp to the flexible hydraulic hose or alternatively tighten the fluid reservoir filler cap onto a sheet of polythene to prevent the loss of brake fluid, then disconnect the hydraulic hose from the caliper by unscrewing the hollow bolt from the banjo union. Note the copper washers, one each side of the union.

2 Unscrew the caliper lockpin bolts and remove the caliper from the carrier bracket (photos).

3 Clean away external dirt, *avoiding inhaling any dust*.

4 Remove the lockpin/sleeve boots and the sleeves.

5 Apply air pressure (such as is generated by a foot-operated pump) to the fluid entry hole in the caliper and eject the piston and the dust excluding seal.

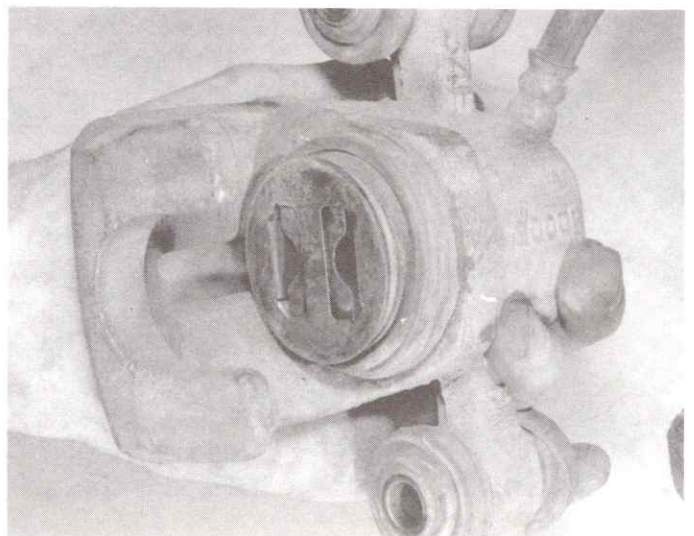
6 Inspect the surfaces of the piston and cylinder bore. If pitted or corroded, renew it complete.

7 If the piston and cylinder are in good condition, use a sharp instrument to pick the piston seal out of its groove and discard it.

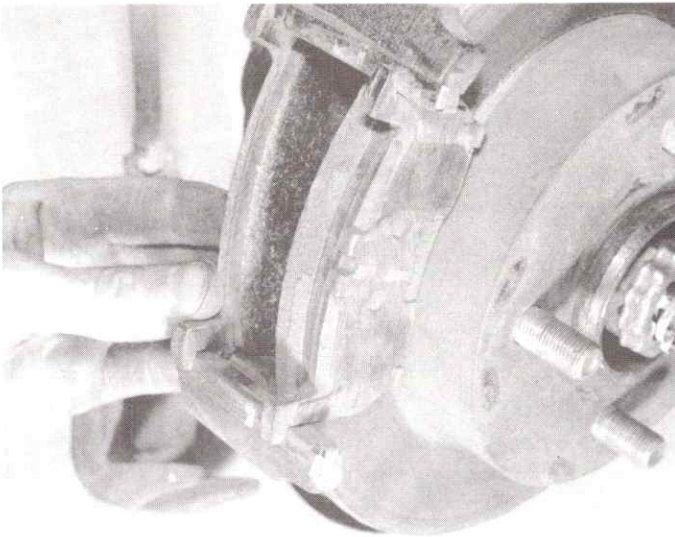
8 Wash all components in methylated spirit or clean hydraulic fluid and obtain a repair kit which will contain all the necessary new seals and other renewable items.

9 Commence reassembly by manipulating the new piston seal into its groove using the fingers only.

10 Push the piston part way into its bore, having first lubricated it with hydraulic fluid.



5.2C The cylinder body comes away ...



5.2D ... leaving the pads in the caliper bracket

- 11 Fit the dust excluder to the piston. Push the piston fully into its bore.
- 12 Smear the sleeves with a little rubber grease and locate them in the caliper, along with their boots.
- 13 Connect the cylinder body to the caliper bracket then insert and tighten the lockpin bolts.
- 14 Connect the hydraulic hose to the caliper.
- 15 Bleed the hydraulic system as described in Section 13 then apply the brakes several times to position the pads on the disc.

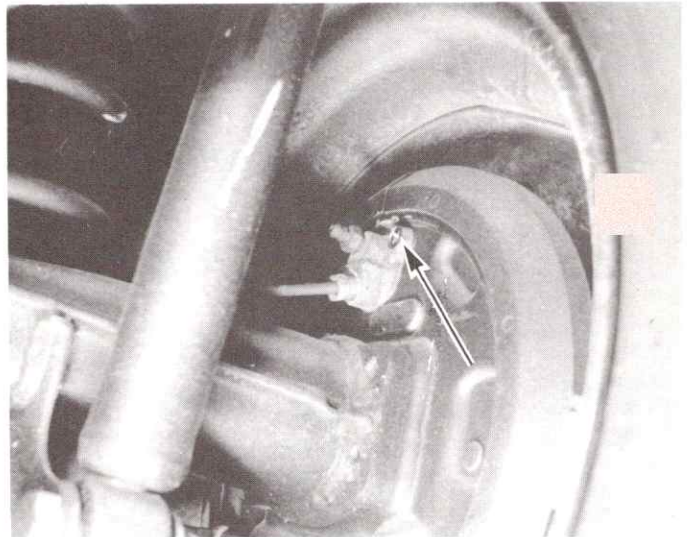
## 6 Disc – inspection and renovation

- 1 Whenever the disc pads are inspected for wear, take the opportunity to examine the disc for deep scoring, grooving or cracks. Light scoring is normal.
- 2 The disc should not run out-of-true by more than the specified tolerance (see Specifications). This may be checked using a dial gauge or feeler blades between the disc and a fixed point as the disc is rotated.
- 3 Provided the thickness of the brake disc will not be reduced below the specified minimum, a scored disc may be reground for further use.
- 4 To remove the disc, first unbolt the brake caliper from the caliper bracket and support it out of the way. Remove the disc pads. Pull the disc from the hub.
- 5 Clean the disc-to-hub mating faces before refitting the disc.
- 6 Push the disc into place and refit the brake pads and caliper.

## 7 Rear wheel cylinder – removal, overhaul and refitting

- 1 Remove the brake shoes, as described in Section 4.
- 2 Disconnect the hydraulic line from the cylinder.
- 3 Unbolt the wheel cylinder from the brake backplate (photo).
- 4 Clean away external dirt and pull off the dust covers.
- 5 Eject the internal components by tapping the cylinder on a block of wood or by applying air pressure from a foot-operated tyre pump to the fluid entry hole. Note which direction the seal lips face.
- 6 Examine the surface of the pistons and cylinder bore. If scored or corroded, renew the wheel cylinder complete.
- 7 If these components are in good condition, clean everything in either methylated spirits or hydraulic fluid, nothing else.
- 8 Discard the old seals and fit the new ones. These are contained in a repair kit, together with other renewable items.

- 9 Assemble the cylinder, applying hydraulic fluid as a lubricant as work progresses.
- 10 Refit the cylinder to the backplate, connect the fluid line and fit the brake shoes.
- 11 Bleed the brake circuit, as described in Section 13.



7.3 Rear wheel cylinder mounting bolt location

## 8 Brake drum – inspection and renovation

- 1 Whenever the brake drum is removed to inspect the wear of the shoe linings, take the opportunity to examine the interior friction surface of the drum.
- 2 If it is badly scored or grooved it is possible to have it machined, provided the internal diameter will not exceed the maximum specified dimension (see Specifications).

## 9 Master cylinder – removal, overhaul and refitting

- 1 Disconnect the fluid lines from the master cylinder and allow the fluid to drain into a suitable container.
- 2 Unbolt the master cylinder from the front face of the vacuum servo unit. Disconnect the low fluid switch wiring where applicable.
- 3 Withdraw the master cylinder, taking care not to spill hydraulic fluid on the paintwork.
- 4 Clean away external dirt.
- 5 Prise off the end cap and be prepared for the primary piston to be ejected.
- 6 Where applicable slightly depress the secondary piston and unscrew and remove the stop screw.
- 7 Shake out the secondary piston. Note the direction in which all seal lips face.
- 8 Inspect the surfaces of the pistons and the cylinder bore. If they are scored or corroded, renew the master cylinder complete.
- 9 If these components are in good condition, clean them in either methylated spirit or hydraulic fluid, nothing else. Discard the seals, and obtain a repair kit which will contain all the necessary new seals and other renewable components. It should be noted that a primary piston of Nabco make is supplied as an assembly.
- 10 Manipulate the new seals into position with the fingers only.
- 11 Renew the reservoir seals. Where applicable, the fast-fill valve assembly can be removed after extracting the circlip. Renew the valve O-ring.
- 12 As reassembly progresses, lubricate the components with clean hydraulic fluid.
- 13 Insert the secondary piston spring and then the assembled

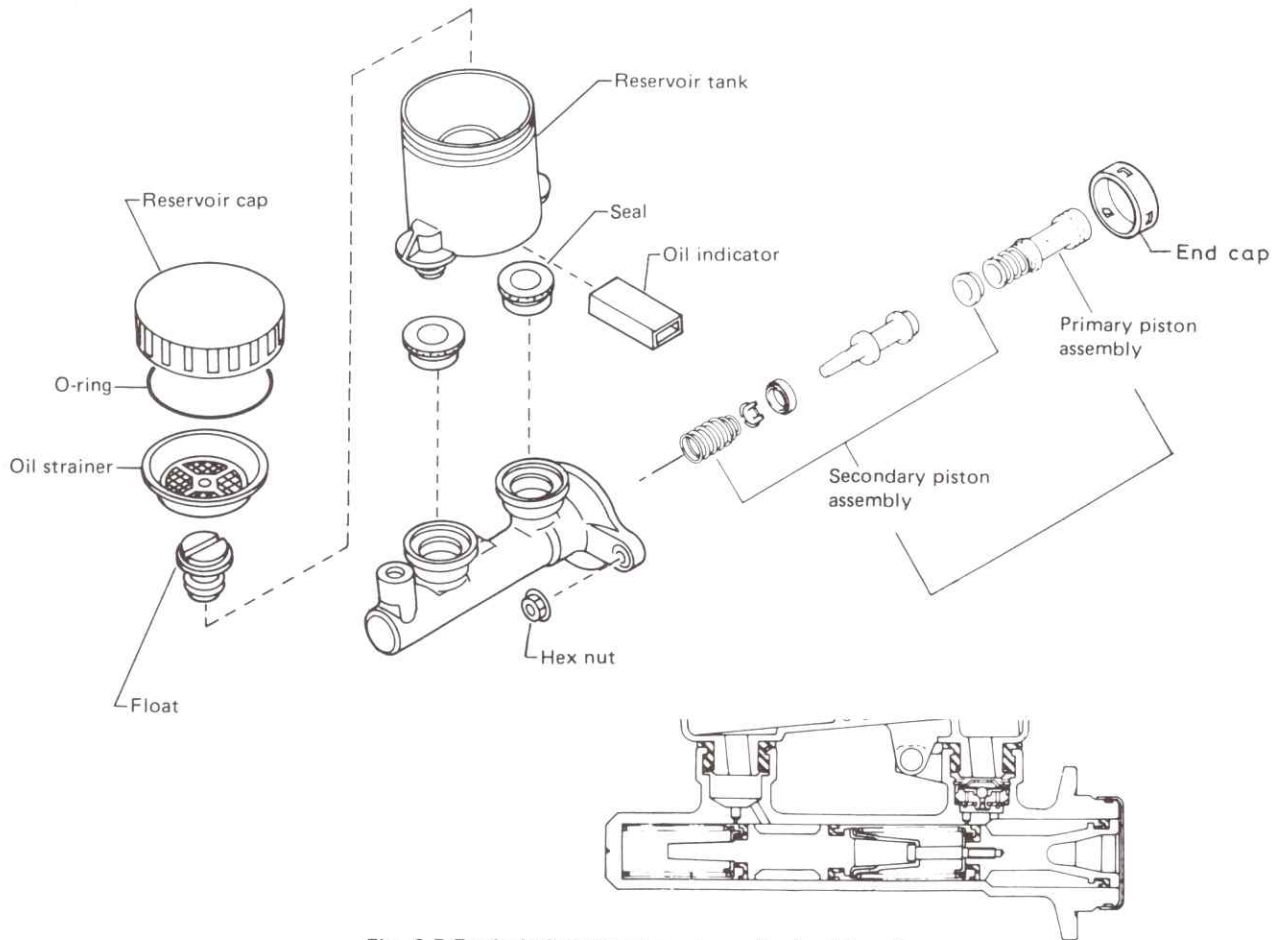


Fig. 9.5 Exploded view of master cylinder (Sec 9)

secondary piston into the cylinder.

14 Where applicable, depress the secondary piston slightly with a rod and screw in the stop screw.

15 Fit the primary piston spring and the primary piston assembly and stake a new end cap into position.

16 Fit the master cylinder to the front face of the vacuum servo unit.

17 Reconnect the fluid pipelines and wiring as applicable.

18 Bleed the complete system, as described in Section 13, however if the fluid reservoir aperture in the master cylinder incorporates a fast-fill valve it is only necessary to bleed the master cylinder using the following procedure.

19 Top up the reservoir and keep it full during the procedure.

20 Disconnect the primary line (nearest the servo), place a container beneath the master cylinder, then fully depress the brake pedal.

21 Release the pedal and wait five seconds.

22 Repeat until clear fluid emerges from the master cylinder, then refit and tighten the primary line.

23 While an assistant depresses the brake pedal loosen the primary line union to bleed the remaining air then tighten the union. If air is still present release the pedal, wait five seconds, and bleed out the remaining air.

24 Bleed the secondary line in a similar manner but instead of waiting five seconds after releasing the pedal, wait twenty seconds.

25 After bleeding the master cylinder, depress the brake pedal and check that it feels firm. If it feels 'spongy', air must be present in another section of the hydraulic circuit and the complete system should then be bled.

#### 10 Pressure regulating valve – general

1 This valve (also referred to as a dual proportioning valve) is located on the engine compartment rear bulkhead.

2 Any fault can only be rectified by renewal of the valve, no repair being possible.

3 Removal is simply a matter of disconnecting the fluid lines and the central anchor bolt. Note the reconnection points for the individual pipelines to facilitate refitting.

4 Bleed the system on completion (Section 13).

#### 11 Pressure regulating valve – testing

1 Undo the unions to the valve and remove it.

2 Apply air pressure to the brake servo side of the valve by blowing into it.

3 If the valve does not open then it needs replacing.

#### 12 Hydraulic pipes and hoses – general

1 Periodically inspect the condition of the flexible brake hoses. If they appear swollen, chafed or when bent double with the fingers tiny cracks are visible they must be renewed.

2 Always uncouple the rigid pipe from the flexible hose first, then release the end of the flexible hose from the support bracket (photo). To do this, pull out the lockplate using a pair of pliers.

3 Now unscrew the flexible hose from the caliper or connector. On calipers, a banjo type hose connector is used. When installing the hose, always use a new sealing washer.

4 When installation is complete, check that the flexible hose does not rub against the tyre or other adjacent components. Its attitude may be altered to overcome this by pulling out the clip at the support bracket and twisting the hose in the required direction by not more than one quarter turn.

- 5 Bleed the hydraulic system (Section 13).
- 6 At regular intervals wipe the steel brake pipes clean and examine them for signs of rust or denting caused by flying stones.
- 7 Examine the fit of the pipes in their insulated securing clips and bend the tongues of the clips if necessary to ensure a positive fit.
- 8 Check that the pipes are not touching any adjacent components or rubbing against any part of the vehicle. Where this is observed, bend the pipe gently away to clear.
- 9 Any section of pipe which is rusty or chafed should be renewed. Brake pipes are available to the correct length and fitted with end unions from most dealers and they can also be made to pattern by many accessory suppliers. When installing the new pipes use the old pipes as a guide to bending and do not make any bends sharper than is necessary.
- 10 The system will of course have to be bled when the circuit has been reconnected.

### 13 Hydraulic system – bleeding

- 1 The two independent hydraulic circuits are as follows:
  - (a) *Front right-hand caliper and left rear wheel cylinder*
  - (b) *Front left-hand caliper and right rear wheel cylinder*

On RHD models (a) is the primary circuit and (b) is the secondary circuit, however on LHD models the circuits are reversed. The *secondary* circuit should be bled first (rear wheel then front wheel), followed by the *primary* circuit (rear wheel then front wheel).

- 2 If the master cylinder or the pressure regulating valve has been disconnected and reconnected then the complete system (both circuits) must be bled.
- 3 If the component of only one circuit has been disturbed then only the particular circuit need be bled.
- 4 Owing to the design of the hydraulic system and pipeline layout, it will be found easier to bleed the system using a pressure bleeding kit. Unless the pressure bleeding method is being used, do not forget to keep the fluid level in the master cylinder reservoir topped-up to prevent air from being drawn into the system which would make any work done worthless.
- 5 Before commencing operations, check that all system hoses and pipes are in good condition with all unions tight and free from leaks.
- 6 Take great care not to allow hydraulic fluid to come into contact with the vehicle paintwork as it is an effective paint-stripper. Wash off any spilled fluid immediately with cold water.
- 7 As the system incorporates a vacuum servo, destroy the vacuum by giving several applications of the brake pedal in quick succession.

#### *Bleeding – two-man method*

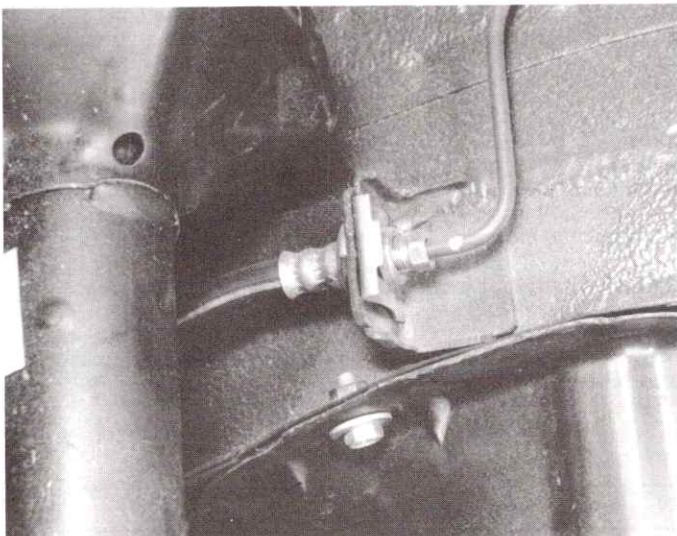
- 8 Gather together a clean glass jar and a length of rubber or plastic tubing which will be a tight fit on the brake bleed screws.
- 9 Engage the help of an assistant.
- 10 Push one end of the bleed tube onto the first bleed screw and immerse the other end in the glass jar which should contain enough hydraulic fluid to cover the end of the tube (photo).
- 11 Open the bleed screw one half turn and have your assistant depress the brake pedal fully then slowly release it. Tighten the bleed screw at the end of each pedal downstroke to obviate any chance of air or fluid being drawn back into the system.
- 12 Wait between 10 and 20 seconds then repeat the operations as many times as is necessary until clean hydraulic fluid, free from air bubbles can be seen coming through into the jar.
- 13 Tighten the bleed screw at the end of a pedal downstroke and remove the bleed tube. Bleed from the remaining screws in a similar way.

#### *Bleeding – using one-way valve kit*

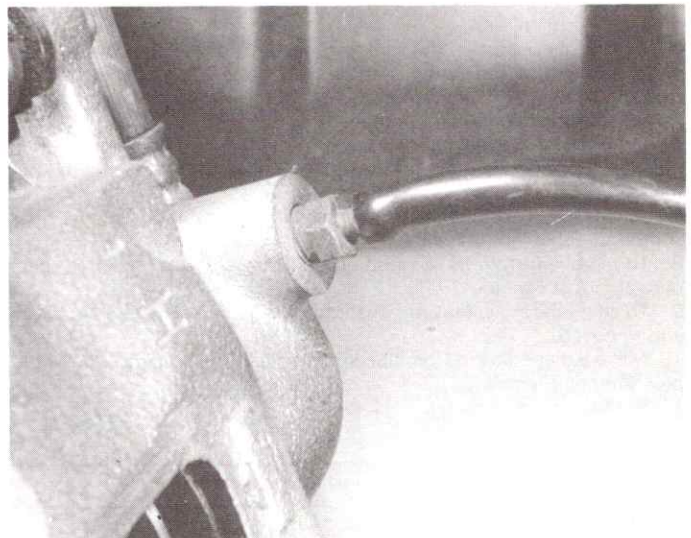
- 14 There are a number of one-man, one-way brake bleeding kits available from motor accessory shops. It is recommended that one of these kits is used wherever possible, rather than just a tube, as it will greatly simplify the bleeding operation and reduce the risk of air or fluid being drawn back into the system, quite apart from being able to do the work without the help of an assistant.
- 15 To use the kit, connect the tube to the bleed screw and open the screw one half turn.
- 16 Depress the brake pedal fully and slowly release it. The one-way valve in the kit will prevent expelled air from returning at the end of each pedal downstroke. Repeat this operation several times to be sure of ejecting all air from the system. Some kits include a translucent container which can be positioned so that the air bubbles can actually be seen being ejected from the system.
- 17 Tighten the bleed screw, remove the tube and repeat the operations in the remaining brakes.
- 18 On completion, depress the brake pedal. If it still feels spongy repeat the bleeding operations as air must still be trapped in the system.

#### *Bleeding – using a pressure bleeding kit*

- 19 These kits are available from motor accessory shops and are usually operated by air pressure from the spare tyre.
- 20 By connecting a pressurised container to the master cylinder fluid reservoir, bleeding is then carried out by simply opening each bleed screw in turn and allowing the fluid to run out, rather like turning on a tap, until no air is visible in the expelled fluid.
- 21 By using this method, the large reserve of hydraulic fluid provides a safeguard against air being drawn into the system during bleeding



12.2 Flexible hose to rigid pipeline connection



13.10 Bleed tube connected to front caliper bleed screw

which often occurs if the fluid level in the reservoir is not maintained.

22 Pressure bleeding is particularly effective when bleeding 'difficult' systems or when bleeding the complete system at a time of routine fluid renewal.

#### *All methods*

23 When bleeding is completed, check and top up the fluid level in the master cylinder reservoir.

24 Check the feel of the brake pedal. If it feels at all spongy, air must still be present in the system and further bleeding is indicated. Failure to bleed satisfactorily after a reasonable repetition of the bleeding operations may be due to worn master cylinder seals.

25 Discard brake fluid which has been expelled. It is almost certain to be contaminated with moisture, air and dirt, making it unsuitable for further use. Clean fluid should always be stored in an airtight container as it absorbs moisture readily (hygroscopic) which lowers its boiling point and could affect braking performance under severe conditions.

### 14 Vacuum servo unit – description and maintenance

1 The vacuum servo unit is fitted into the brake hydraulic circuit in series with the master cylinder to provide assistance to the driver when the brake pedal is depressed. This reduces the effort required by the driver to operate the brakes under all braking conditions.

2 The unit operates by vacuum obtained from the induction manifold and comprises, basically, a booster diaphragm and non-return valve. The servo unit and hydraulic master cylinder are connected together so that the servo piston rod acts as the master cylinder pushrod: The driver's effort is transmitted through another pushrod to the servo unit piston and its built-in control system. The servo unit piston does not fit tightly into the cylinder, but has a strong diaphragm to keep its edges in constant contact with the cylinder wall, so assuring an airtight seal between two parts. The forward chamber is held under vacuum conditions created in the inlet manifold of the engine and, during periods when the brake pedal is not used, the controls open a passage to the rear chamber so placing it under vacuum conditions as well. When the brake pedal is depressed, the vacuum passage to the rear chamber is cut off and the chamber opened to atmospheric pressure. The consequent rush of air pushes the servo piston forward in the vacuum chamber and operates the main pushrod to the master cylinder.

3 The controls are designed so that assistance is given under all conditions and when the brakes are not required, vacuum in the rear chamber is established when the brake pedal is released. All air from the atmosphere entering the rear chamber is passed through a small air filter.

4 Under normal operating conditions the vacuum servo unit is very reliable and does not require overhaul except at very high mileages, in this case it is far better to obtain a service exchange unit, rather than repair the original unit.

5 It is emphasised that the servo unit assists in reducing the braking effort required at the foot pedal and, in the event of its failure, the hydraulic braking system is in no way affected except that the need for higher pedal pressure will be noticed.

6 Periodically inspect the condition of the vacuum hose in which is incorporated a non-return valve (photo). Renew the hose if it is split or has hardened.

7 At the specified intervals (or earlier in dusty climates) the air filter should be renewed.

8 To remove it from its location around the servo unit pushrod, peel back the dust excluder.

9 To save disconnecting the pushrod, the old filter may be cut away and removed.

10 Make a diagonal cut from the centre hole to the outside edge of the new filter and install it.

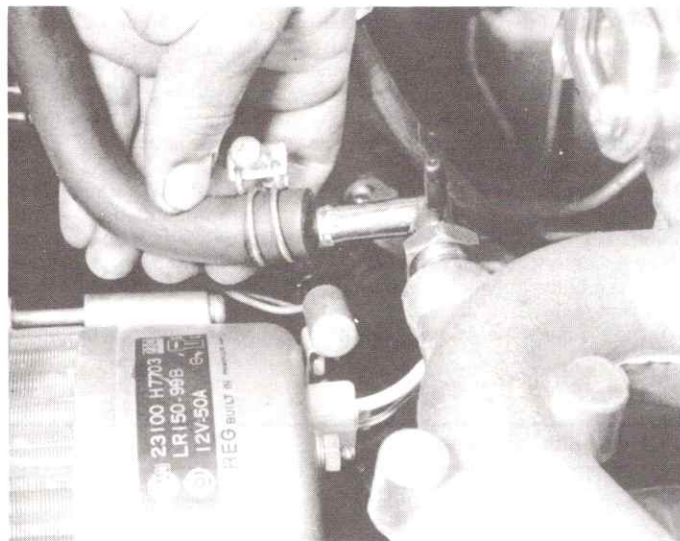
11 Refit the dust excluder.

### 15 Vacuum servo unit – removal and refitting

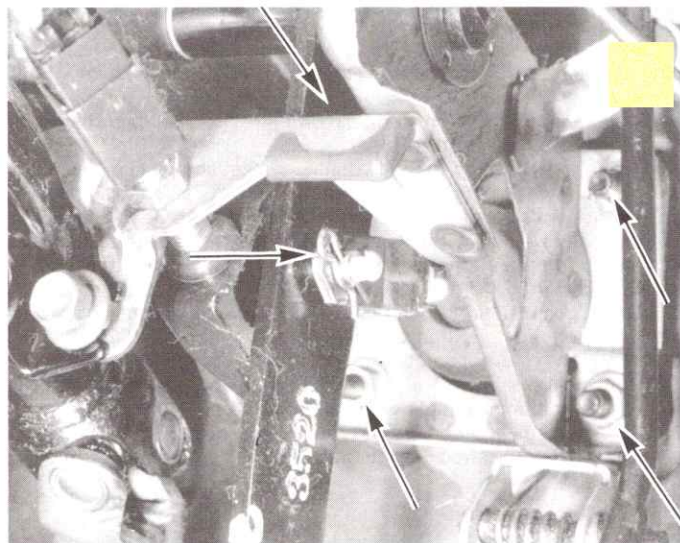
1 Remove the master cylinder, as described in Section 9.

2 Disconnect the vacuum hose from the servo unit.

3 Working inside the vehicle, disconnect the pushrod from the brake pedal.



14.6 Vacuum servo hose at the intake manifold



15.4 Showing brake pedal pushrod and vacuum servo unit mounting nuts (arrowed)

4 Unbolt the brake servo unit from the bulkhead and remove it (photo).

5 Refitting is a reversal of removal, but carry out the following checks before actually installing it.

6 Check the projection (A) of the pushrod which enters the master cylinder (see Fig. 9.6) The projection is set in production and the threads locked, so if it does not conform to specifications renew the complete unit.

7 Now check the length (B) of the pushrod which connects with the brake pedal (see Fig. 9.7). Adjust if necessary by turning the clevis fork after having released the locknut.

### 16 Handbrake – adjustment

1 The handbrake is adjusted by the action of the rear shoe automatic adjuster and will require no further attention unless the cable stretches, normally only after a high mileage has been covered.

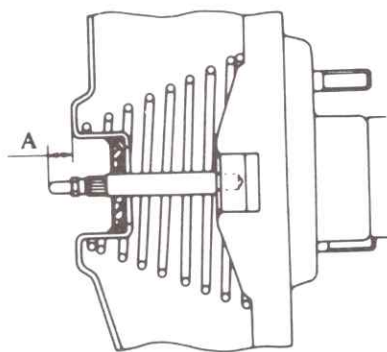


Fig. 9.6 Vacuum servo unit-to-master cylinder pushrod dimension (Sec 15)

$A = 0.406 \text{ to } 0.413 \text{ in (10.3 to 10.3 mm)}$

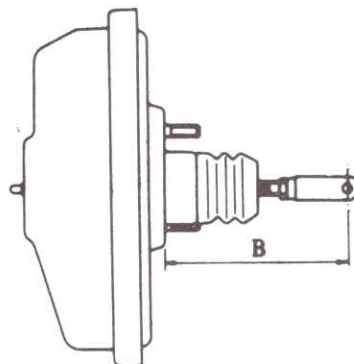


Fig. 9.7 Brake pedal-to-vacuum servo unit pushrod setting dimension (Sec 15)

$B = 5.20 \text{ in (132.0 mm)}$

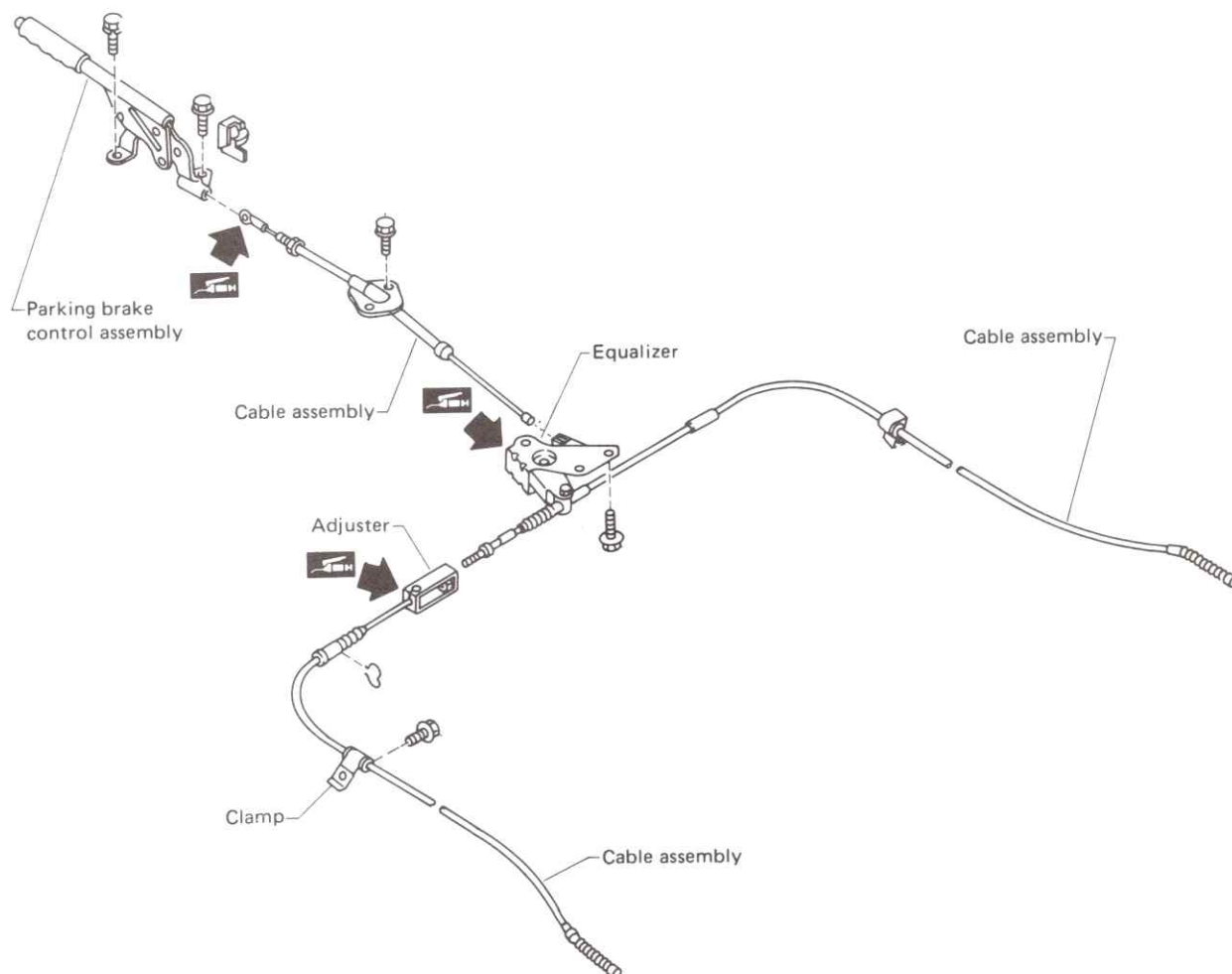
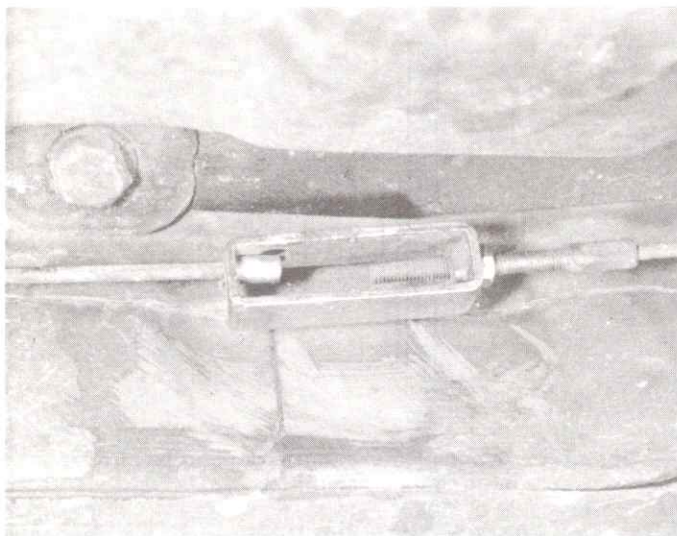
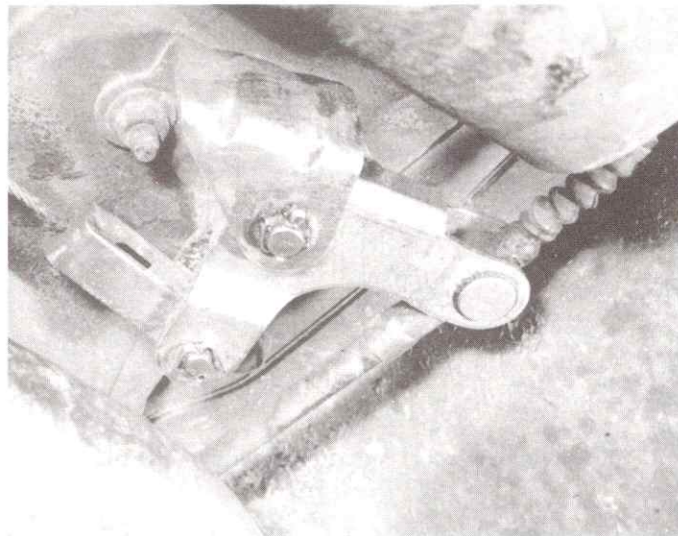


Fig. 9.8 Diagrammatic view of handbrake cable assembly (Sec 16 and 17)



16.3A Handbrake cable adjustment point



16.3B Handbrake cable equaliser

2 The handbrake should be fully applied with the rear wheels locked if the handbrake control lever is pulled up 6 to 7 notches (clicks) of the ratchet.

3 If the lever moves over an excessive number of notches, release the handbrake and adjust the cable by moving the locknuts at the cable stirrup which is adjacent to the equaliser under the vehicle (photos).

4 Keep the groove in the equaliser well greased at all times.

5 Working inside the vehicle, remove the centre console (see Chapter 11) and bend the handbrake warning switchplate down so that, with the ignition on, the warning lamp comes on when the lever is pulled up one notch.

2 Working inside the vehicle, remove the centre console, as described in Chapter 11.

3 Disconnect the lead from the handbrake warning switch (photo).

4 Remove the seat belt stalks.

5 Remove the hand control lever fixing screws and the cable bush fixing screws (photo).

6 Withdraw the hand control lever with the primary cable attached into the vehicle interior.

7 To separate the primary cable from the control lever, drill out the connecting pin.

8 Refitting is a reversal of removal, a clevis pin and cotter pin are supplied for connecting the new cable to the hand control lever.

9 Adjust, as described in the preceding Section.

## 17 Handbrake cables – renewal

### Primary cable

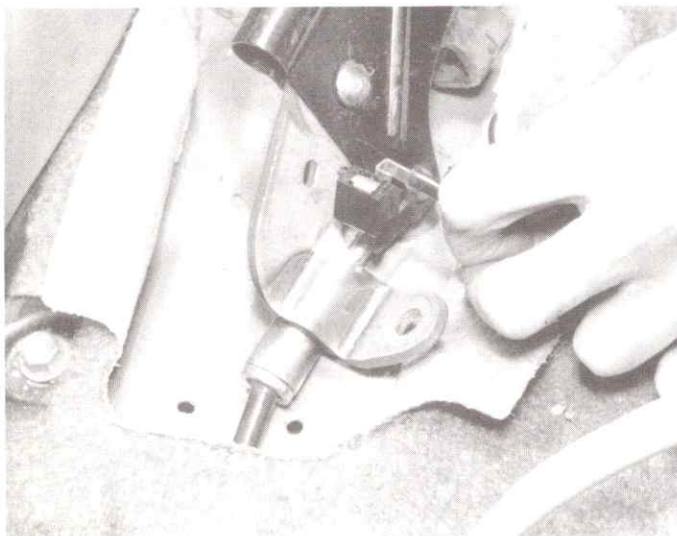
1 Disconnect the secondary cable from the connecting stirrup which is adjacent to the equaliser under the vehicle (see photo 16.3B). Do this by unscrewing the locknuts and then passing the cable end fitting through the groove in the equaliser.

### Secondary cable

10 Disconnect the cable at the stirrup which is adjacent to the equaliser under the vehicle.

11 Draw the longer cable through the groove in the equaliser.

12 Bend back the cable clips on the rear suspension arms and release the cables.



17.3 Handbrake warning switch lead



17.5 Handbrake lever fixing bolts

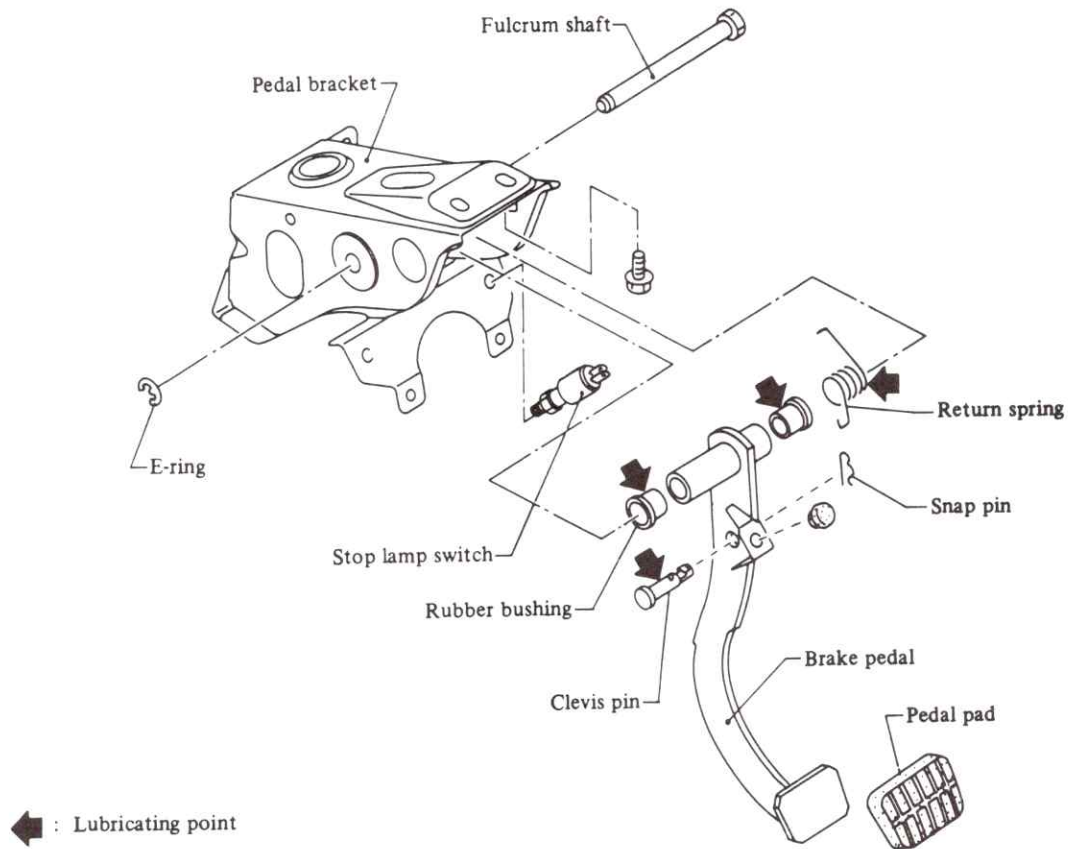


Fig. 9.9 The component parts of the brake pedal assembly (Sec 18)

- 13 Raise the rear of the vehicle, support it securely and chock the front wheels. Remove both roadwheels and brake drums.
- 14 Unhook the handbrake cable and fittings from the handbrake lever on the brake shoes.
- 15 Remove both cables through the brake backplates.
- 16 Fit the new cables by reversing the removal operations. Apply grease to the cable friction surfaces.
- 17 Refit the brake drums and adjust the bearings, as described in Chapter 10.
- 18 Refit the roadwheels.
- 19 Adjust the cables, as described in the preceding Section.

### 18 Brake pedal – removal, refitting and adjustment

- 1 Working within the vehicle, under the fascia panel, disconnect the pushrod from the brake pedal arm. Where necessary the lower fascia panel and heater duct must be removed.
- 2 Prise the clip from the end of the pivot shaft, then unhook the return spring and withdraw the clutch pedal.
- 3 Slide the pivot shaft from the bracket and lower the brake pedal.
- 4 The pivot bushes may be renewed.
- 5 Refitting is a reversal of removal, but apply grease to the pivot shaft and bushes and check the pedal height as follows.
- 6 Measure the distance from the upper surface of the brake pedal pad to the floor pan or steering hole cover as shown in Fig. 9.10. If the dimension is not as specified, loosen the locknut and turn the pedal pushrod as required making sure that the end of the rod protrudes into the clevis. Tighten the locknut after adjusting the rod.
- 7 With the pedal fully released check that the specified clearance exists between the pedal and stop-lamp switch. If not, loosen the

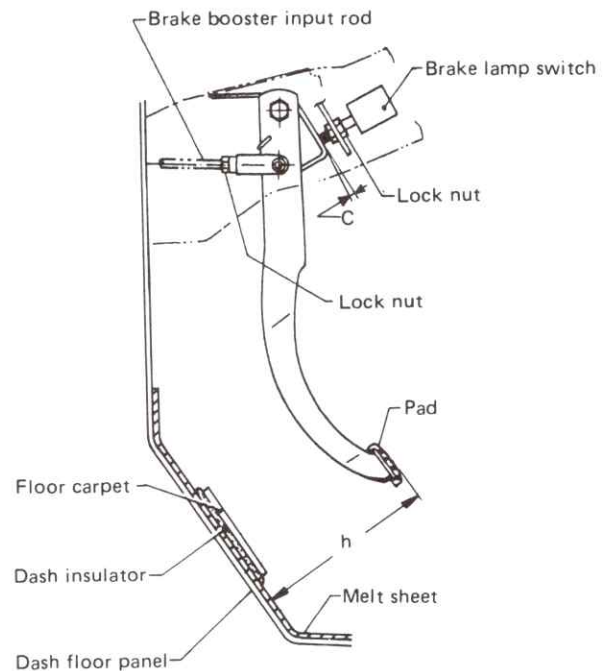
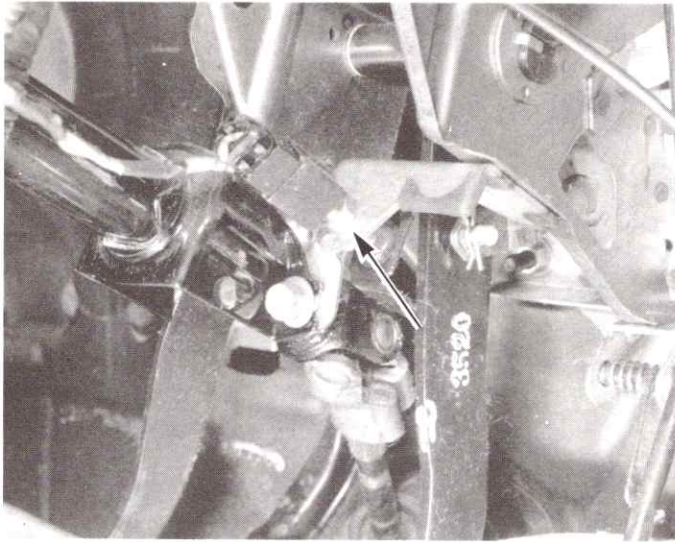


Fig. 9.10 Brake pedal height adjustment (Sec 18)

$h = 7.99$  to  $8.39$  in ( $203.0$  to  $213.0$  mm) manual transmission  
 $h = 8.07$  to  $8.46$  in ( $205.0$  to  $215.0$  mm) automatic transmission  
 $c = 0$  to  $0.04$  in ( $0$  to  $1.0$  mm)



18.7 Stop lamp switch locknut

locknut and adjust the stop-lamp as necessary, then tighten the locknut (photo).

8 Finally run the engine and check that the depressed height of the pedal is as specified (Fig. 9.11). If below the minimum amount check the hydraulic system for leaks or accumulation of air.

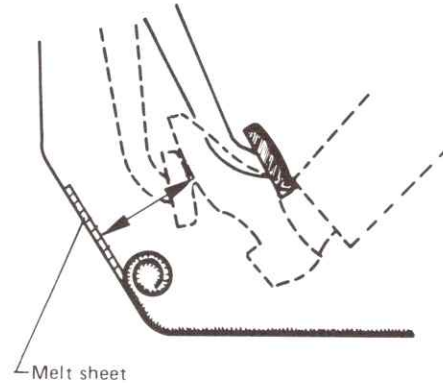


Fig. 9.11 Brake pedal depressed height (Sec 18)

*Depressed height = 4.13in (105.0 mm)  
(under a force of 110 lbf (50 kgf), engine running)*

## 19 Fault diagnosis – braking system

Symptom	Reason(s)
Pedal travels a long way before the brakes operate	Incorrect pedal adjustment Brake shoes set too far from the drums (seized adjuster)
Stopping ability poor, even though pedal pressure is firm	Linings, discs or drums badly worn or scored One or more wheel hydraulic cylinders seized, resulting in some brake shoes not pressing against the drums (or pads against disc) Brake linings contaminated with oil Wrong type of linings fitted (too hard) Brake shoes wrongly assembled Servo unit not functioning
Car veers to one side when the brakes are applied	Brake pads or linings on one side are contaminated with oil Hydraulic wheel cylinder on one side partially or fully seized A mixture of lining materials fitted between sides Brake disc not matched Unequal wear between sides caused by partially seized wheel cylinders
Pedal feels spongy when the brakes are applied	Air is present in the hydraulic system
Pedal feels springy when the brakes are applied	Brake linings not bedded in (after fitting new ones) Master cylinder or brake backplate mounting bolts loose Severe wear in brake drums causing distortion when brakes are applied Discs out of true
Pedal travels right down with little or no resistance and brakes are virtually non-operative	Leak in hydraulic system resulting in lack of pressure for operating wheel cylinders If no signs of leakage are apparent the master cylinder internal seals are failing to sustain pressure
Binding, juddering, overheating	One or a combination of reasons given above Shoes installed incorrectly with reference to leading and trailing ends Broken shoe return spring Disc worn Drum distorted Incorrect pedal adjustment
Lack of servo assistance	Vacuum hose disconnected or leaking Non-return valve defective or incorrectly fitted Servo internal defect

# Chapter 10 Suspension and steering

For modifications, and information applicable to later models, see Supplement at end of manual

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## Specifications

### Front suspension

Type .....	MacPherson type strut and transverse links
Hub bearing turning effort .....	3.5 to 12.3 lbf (1.6 to 5.6 kgf)

### Rear suspension

Type .....	Dead axle with four link location, coil spring and telescopic dampers
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### Steering

Type .....	Rack and pinion with universally jointed column. Optional power assistance
Steering angles:	
Camber (non-adjustable) .....	–0°25' to + 1°05'
Castor (non-adjustable) .....	+ 1°30' to + 3°00'
Kingpin inclination (non-adjustable) .....	+ 12°25' to + 13°55'
Toe-in .....	2.0 to 4.0 mm (0.08 to 0.16 in)
Steering ratio:	
Manual steering .....	18.9 : 1
Power-assisted steering .....	16.2 : 1
Number of turns lock-to-lock:	
Manual steering .....	3.5
Power-assisted steering .....	3.0
System fluid capacity:	
Power-assisted steering .....	1.76 pt (1.0 litre)
Power-assisted steering fluid type .....	Dexron II type ATF (Duckhams D-Matic)

### Roadwheels

Type .....	Pressed steel or light alloy
Size:	
Pressed steel .....	4J-12
Light alloy .....	4 1/2J-12

### Tyres

Size .....	145 SR 12 or 155 SR 12
Pressures .....	Refer to tyre pressure plate on vehicle

### Torque wrench settings

#### Front suspension

	lbf ft	kgf m
Strut piston rod self-locking nut .....	23 to 31	3.2 to 4.3
Strut upper mounting bolts .....	19 to 22	2.6 to 3.1
Strut-to-knuckle .....	58 to 72	8 to 10
Lower balljoint to transverse link .....	36 to 43	5 to 6
Transverse link front bush .....	65 to 80	9 to 11
Transverse link rear bush .....	27 to 35	3.7 to 4.8
Steering tie-rod:		
Lock nut .....	27 to 34	3.7 to 4.7
Stud nut .....	22 to 29	3.0 to 4.0

**Torque wrench settings***Rear suspension*

	lbf ft	kgf m
Shock absorber upper mounting .....	14 to 19	1.9 to 2.6
Shock absorber lower mounting bolt .....	35 to 44	4.9 to 6.1
Brake back plate attachment bolts .....	25 to 33	3.4 to 4.6
Wheelnuts .....	58 to 72	8.0 to 10.0
Wheel hub nut (preliminary setting -- see text) .....	29 to 33	4.0 to 4.5

*Steering*

Steering wheel nut .....	29 to 40	4.0 to 5.5
Steering shaft lower pinch-bolt:		
M10 size .....	23 to 31	3.2 to 4.3
M8 size .....	17 to 22	2.4 to 3.0
Lower bracket to pedal bracket .....	6.5 to 10.1	0.9 to 1.4
Steering column clamp to body .....	6.5 to 10.1	0.9 to 1.4
Steering gear rack mounting brackets .....	43 to 58	6.0 to 8.0
Fluid pump to engine mounting .....	23 to 31	3.2 to 4.3
Belt tensioning bolt locknut .....	6.5 to 8.7	0.9 to 1.2
Pulley locknut .....	23 to 31	3.2 to 4.3
High pressure pipe connections .....	22 to 36	3.0 to 5.0
Low pressure pipe connections .....	0.7 to 1.4	0.1 to 0.2

**1 General description**

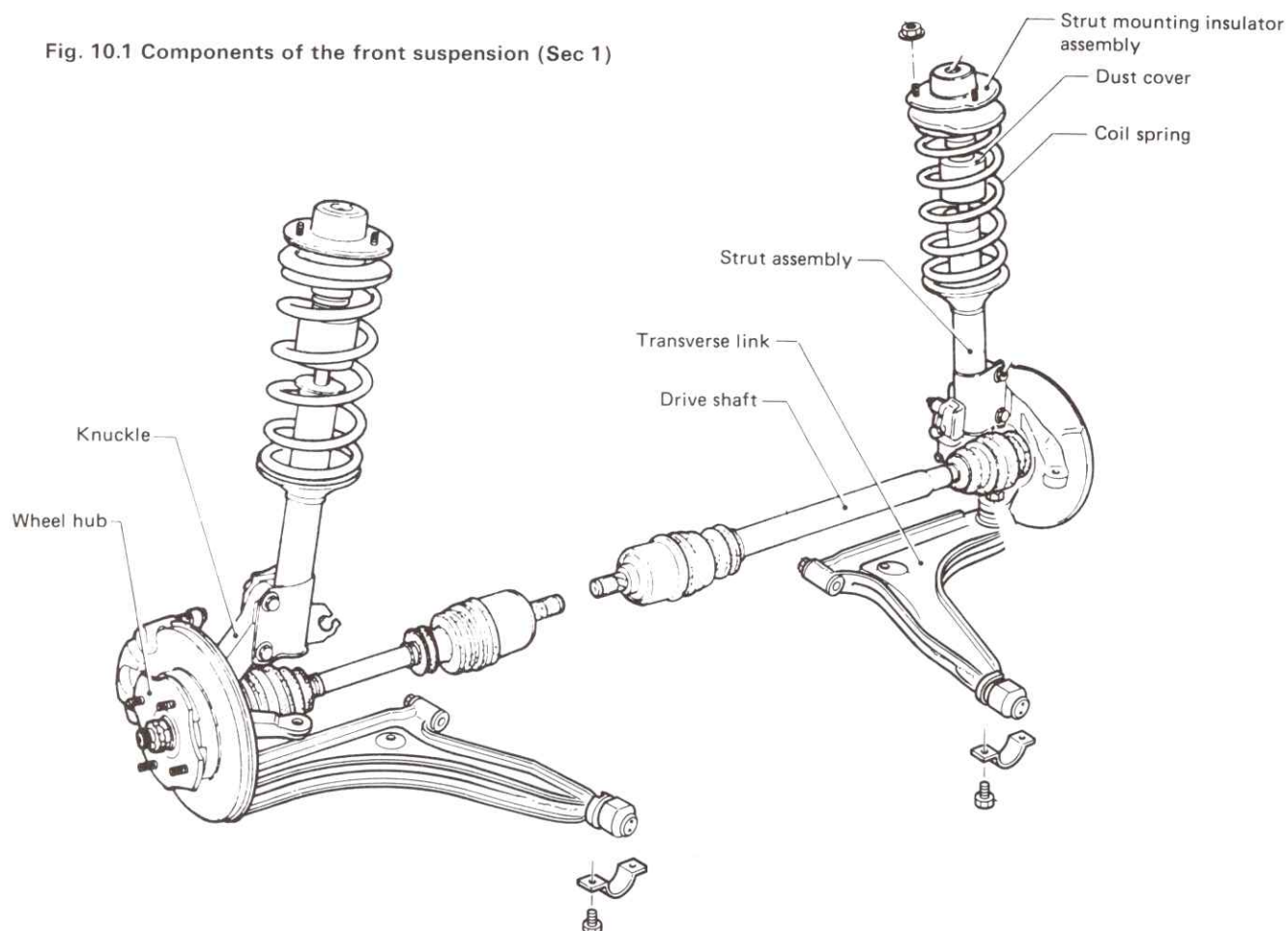
Front suspension is by MacPherson type strut and transverse link.

Rear suspension is by dead axle with four link location, coil springs and double-acting telescopic dampers.

Steering is by rack and pinion, with a universally jointed steering column.

Front and rear wheels run on taper roller bearings, but only the rear bearings are adjustable in service, the front bearings having preload applied to them by means of spacers of different thicknesses.

Fig. 10.1 Components of the front suspension (Sec 1)



\*: Rubber parts:

Be careful not to allow oil or grease to come into contact with rubber parts.

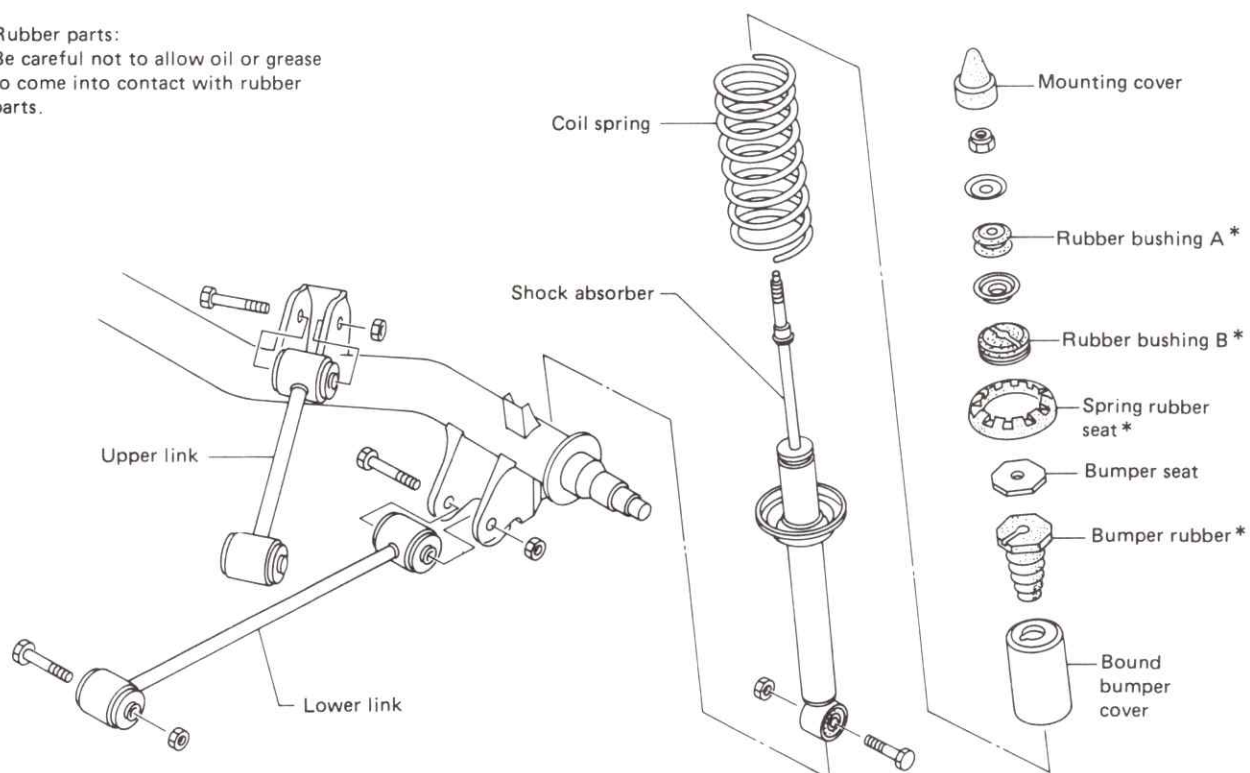


Fig. 10.2 Components of the rear suspension (Sec 1)

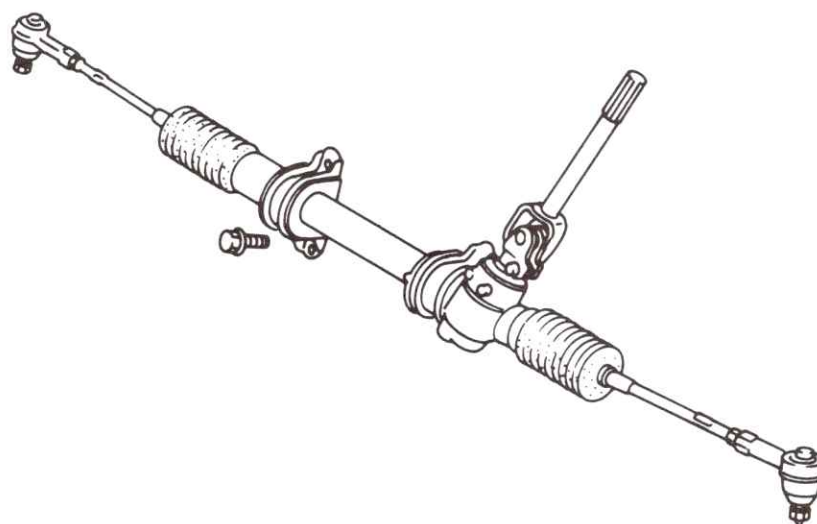


Fig. 10.3 Typical rack and pinion steering assembly (Sec 1)

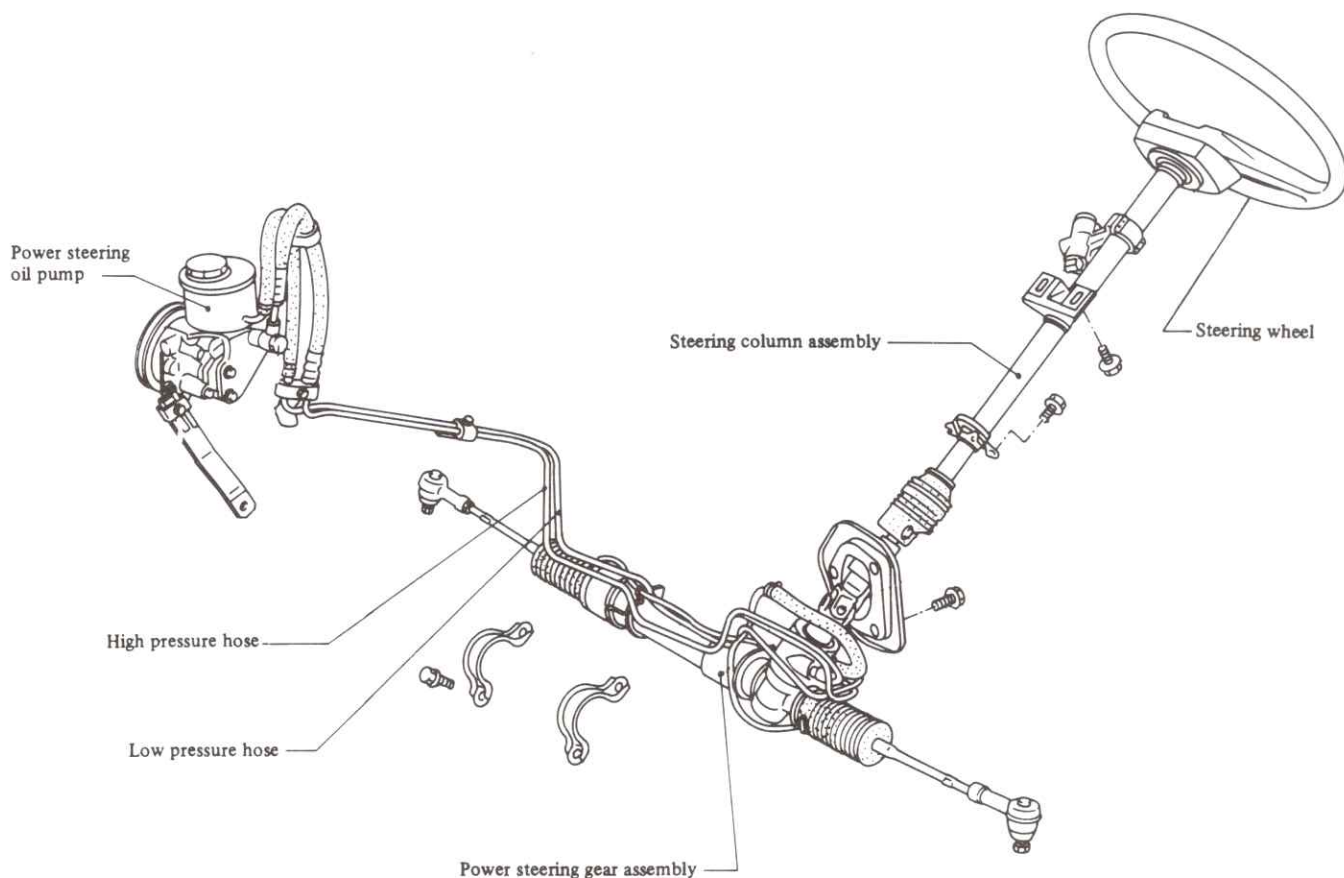


Fig. 10.4 Typical power-assisted steering system (Sec 1)

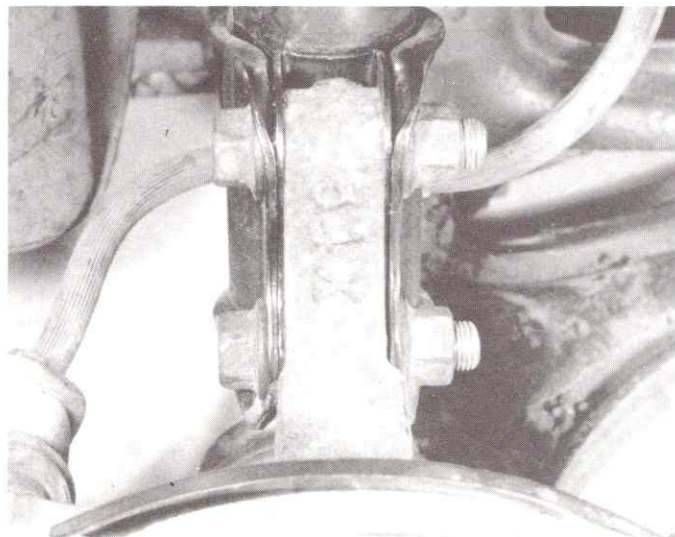
## 2 Routine maintenance

- 1 Every 6000 miles (10 000 km) or 6 months whichever comes first, check the power steering fluid level in the reservoir and top up as necessary. Also check the power steering hoses for conditions and security.
- 2 Every 12 000 miles (20 000 km) or 12 months whichever comes first, check the power steering pump drivebelt for condition and tension.
- 3 Every 12 000 miles (20 000 km) or 12 months whichever comes first, check the steering and suspension components including all balljoints for excessive wear, adjust the rear wheel bearings and check the front wheel bearings for wear and leakage of grease. Check, and if necessary, adjust the front wheel alignment. Change the roadwheel positions and have them balanced.
- 4 If the car is operated under extreme conditions the maintenance intervals should be more frequent, and the mileages reduced accordingly.

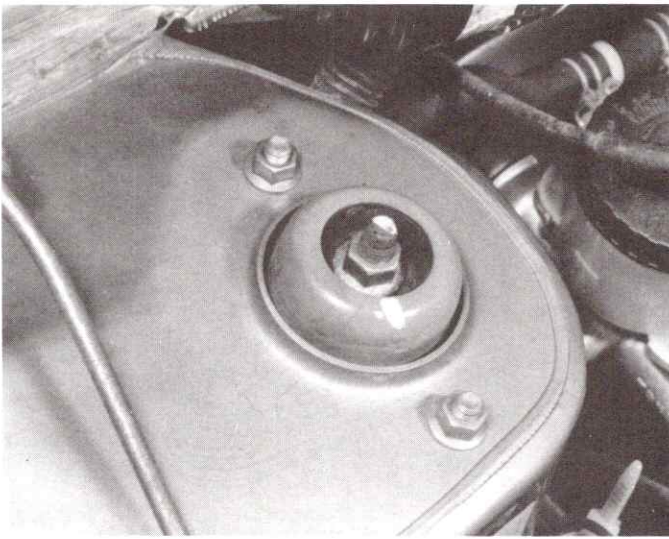
## 3 Front suspension strut – removal, overhaul and refitting

- 1 Raise the front of the vehicle and support it securely on axle stands placed under the side-members.
- 2 Remove the roadwheel.
- 3 Disconnect the hydraulic brake pipe from the suspension strut where applicable.
- 4 Support the suspension lower arm on a jack.
- 5 Unscrew the two pinch-bolts which hold the base of the suspension strut (photo).

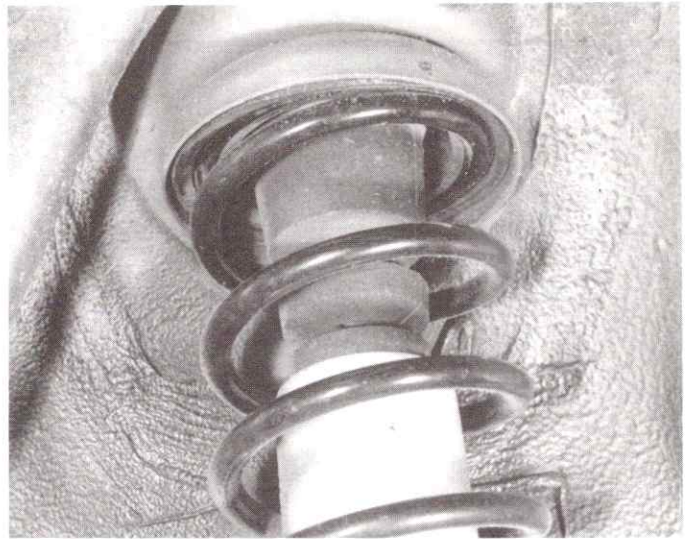
- 6 Working at the top of the inner wing within the engine compartment, unscrew and remove the two nuts which secure the strut top mounting (photo).
- 7 Support the strut assembly and withdraw it from under the ring (photo).



3.5 Remove the two pinch-bolts



3.6 Showing top of shock absorber mounting in engine compartment



3.7 Looking under the wing at the strut assembly

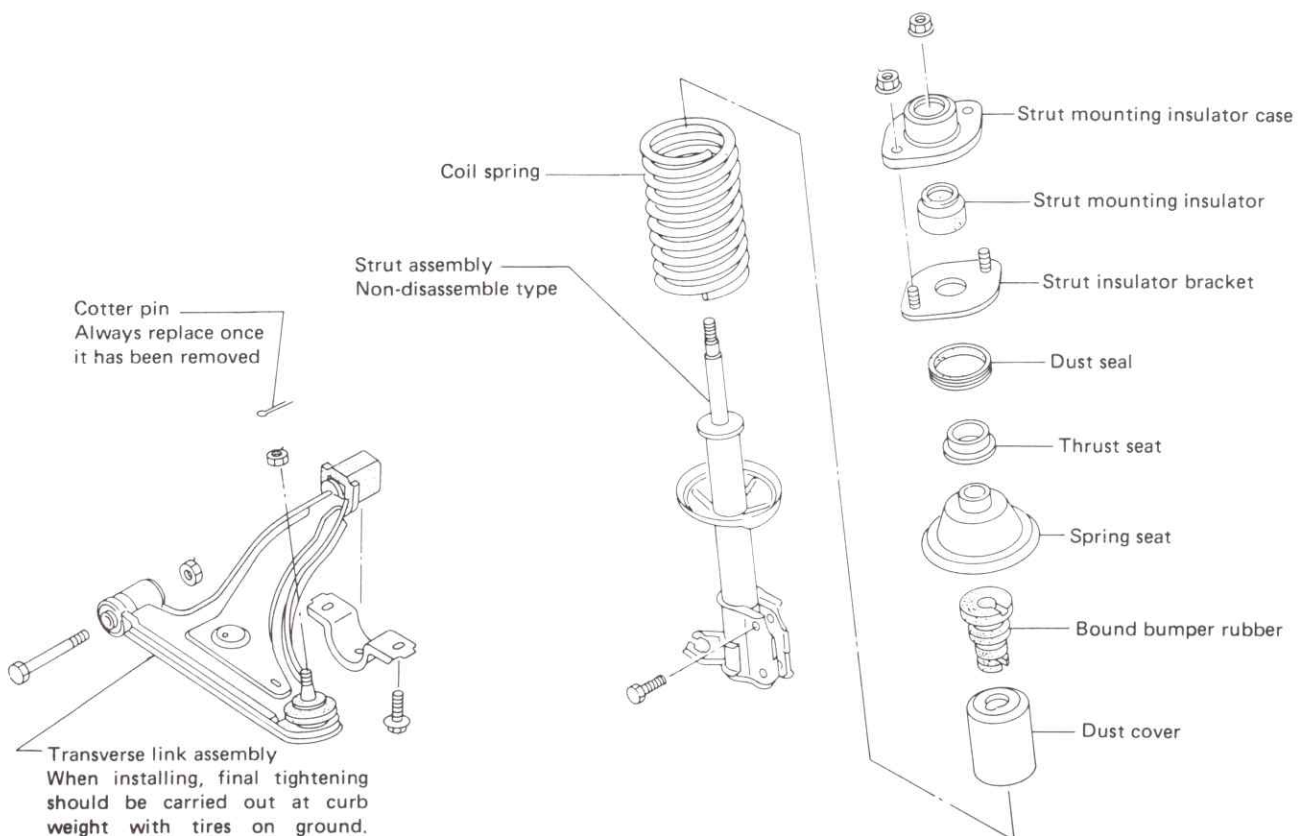


Fig. 10.5 Exploded view of the front suspension (Sec 3)

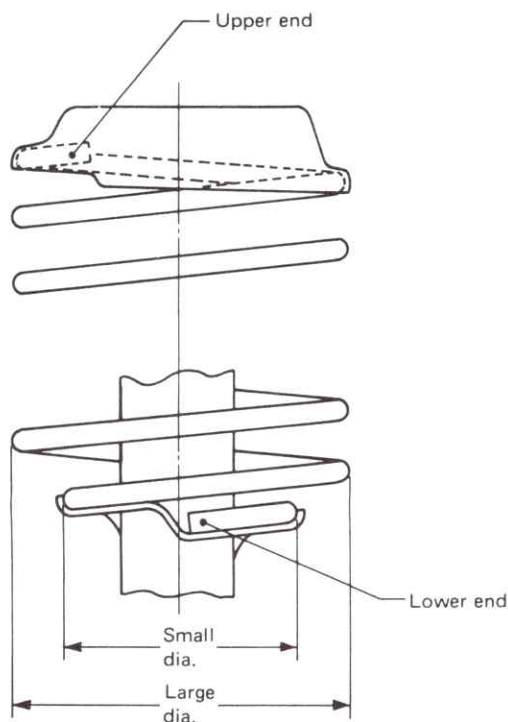


Fig. 10.6 Correct location of front coil spring (Sec 3)

8 Unless coil spring compressors are available do not carry out any further dismantling.

9 Where compressors are available (they can be purchased at most motor accessory stores) fit them to the strut coil spring and compress the spring just sufficiently to be able to turn the strut upper mounting insulator by hand.

10 Unscrew the self-locking nut from the top of the piston rod. Flats are machined on the rod so that an open-end spanner can be used to prevent the rod rotating while the unit is unscrewed.

11 Take off the mounting insulator, the thrust seat, the dust seal, the spring upper seat, the rebound rubber, coil spring (with compressors) and the dust excluder.

12 Unless the coil spring is to be renewed, the compressors can remain on the spring for reassembly.

13 If the strut is distorted, leaking or has lost its damping qualities, then the strut tube must be renewed, no repair being possible. The renewal of both struts is advised.

14 Reassemble the strut by fitting the spring in its compressed state followed by the upper mounting components in their originally fitted sequence. Apply grease to the underside of the thrust plate.

15 Tighten the piston rod self-locking nut to the specified torque and then gently remove the spring compressors. Make sure that the spring lower end is in full contact with the abutment on the lower seat.

16 Offer the strut to its mounting under the wing. Screw on the nuts finger tight.

17 Reconnect the base of the strut to the knuckle.

18 Reconnect the brake pipe to the strut where applicable.

19 Refit the roadwheel and lower the vehicle to the ground.

20 Tighten all nuts and bolts to the specified torques.

#### 4 Front suspension transverse link – removal and refitting

1 Raise the vehicle and support it on stands placed under the side-members.

2 Remove the roadwheel.

3 Remove the driveshaft (Chapter 8).

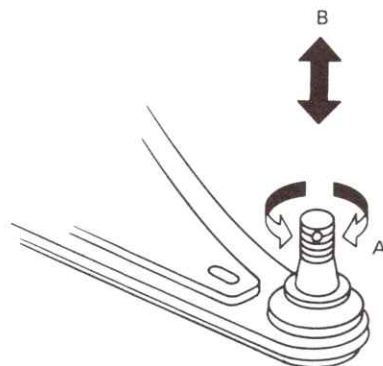
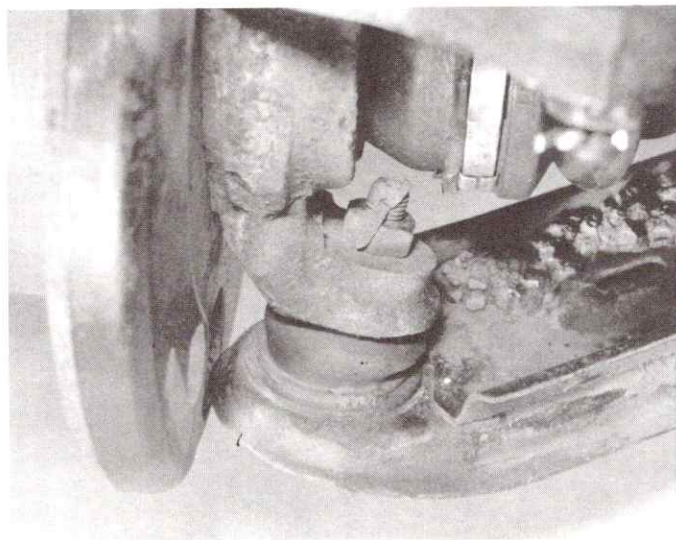


Fig. 10.7 Lower balljoint inspection (Sec 4)

A = Turning torque 4.3 to 30.0 lbf in (5.0 to 35 kgf cm)

B = Axial play (no tolerance allowed)



#### 4.4 Lower balljoint on transverse link

4 Remove the split pin and nut from the lower balljoint on the transverse link (photo) and separate the balljoint. It may be necessary to use a balljoint separator to do this.

5 Remove the nuts and bolts from the front and rear transverse link mounting bushes and remove the transverse link.

6 Inspect the balljoint for excessive wear and lateral play, and ensure that it can rotate in its housing. If it is worn then the whole transverse link will have to be renewed.

7 Inspect the rubber mounting bushes and renew any which show signs of wear or age.

8 Refitting is a reversal of this procedure, but note that all nuts and bolts should not be tightened to their final torque until the weight of the vehicle is back on the suspension units.

#### 5 Front axle wheel bearings and knuckle assembly – removal and refitting

1 Remove the driveshaft as described in Chapter 8.

2 With the steering tie-rod disconnected, the lower balljoint separated and the brake caliper tied out of the way, the knuckle and bearing assembly can now be removed from the bottom of the MacPherson strut and transferred to the bench.

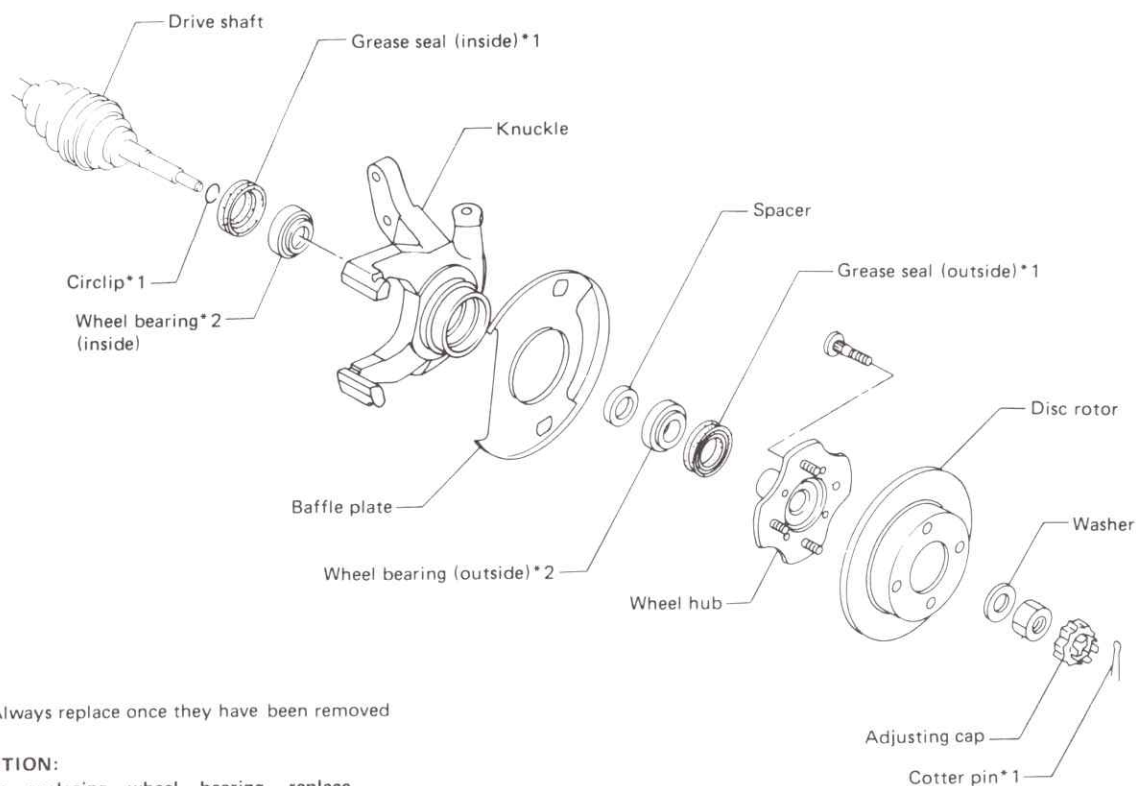


Fig. 10.8 Exploded view of front wheel hub and knuckle (Sec 5)

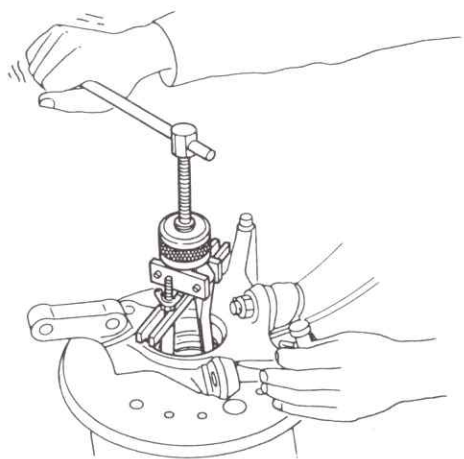


Fig. 10.9 Using a puller to remove the outer bearing (Sec 5)

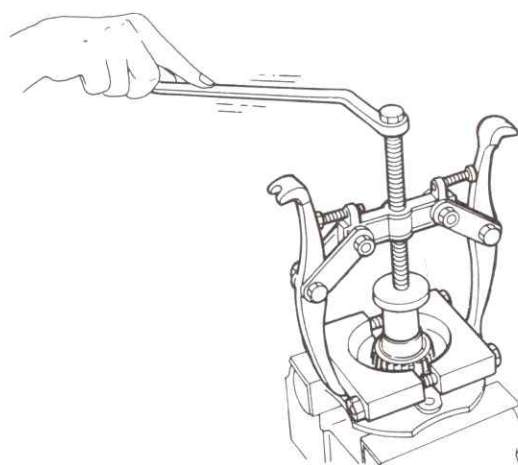


Fig. 10.10 Using a puller to remove the inner bearing (Sec 5)

- 3 Prise out the grease seals. Use new seals on reassembly.
- 4 Use pullers to remove the inner and outer bearing races.
- 5 Inspect the bearings for wear, pitting or scoring and check that they run freely, without any 'rattle'.
- 6 Bearings should be renewed as a set of inner and outer.
- 7 Check the hub for any signs of cracking, and inspect the brake disc rotor as described in Chapter 9.
- 8 Coat each bearing with lithium based grease before pressing them back into the hub using a suitably sized mandrel.
- 9 Smear some grease onto the grease seals and fit them to the inner and outer bearings, noting that the spring tensioned lip faces outwards.
- 10 Fit the spacer. If the spacer is being renewed, then it should bear the same identification mark as the old one.
- 11 If a new knuckle is being fitted, then the size of spacer to use will have to be determined as follows.
- 12 To calculate the thickness of spacer to use, measure the distance

between the inner faces of the two bearings (Fig. 10.13). From this figure subtract 0.0469 in (1.19 mm). The result will be the size of spacer to use. Spacers are available in varying thicknesses from your Nissan dealer.

13 To ensure correct bearing preload on fitment of a new spacer, the turning movement of the hub should be measured after it has been reassembled.

14 With the spacer fitted, insert the driveshaft outer joint into the knuckle, then fit and tighten the hub nut to the specified torque.

15 Refer to Fig. 10.14 and attach a spring balance to one of the wheel nut studs. Pull the spring balance, gently, at a tangent. The figure on the spring balance should be noted and compared with the figure given in the Specifications. If the bearing preload is too low, fit a thinner spacer, and if it is too high fit a thicker one. Repeat this operation until the correct preload is obtained.

16 Complete reassembly by reversing the removal operations.

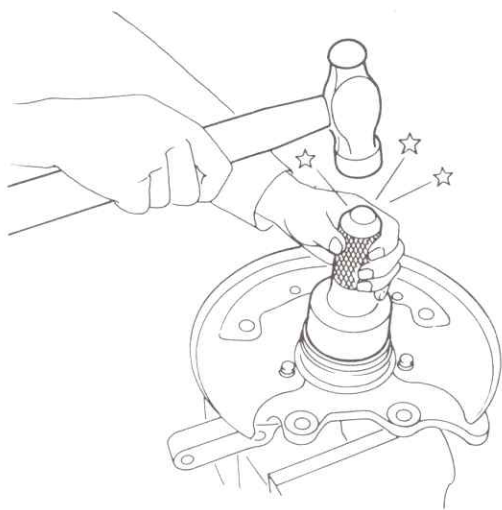


Fig. 10.11 Installing the inner bearing (Sec 5)

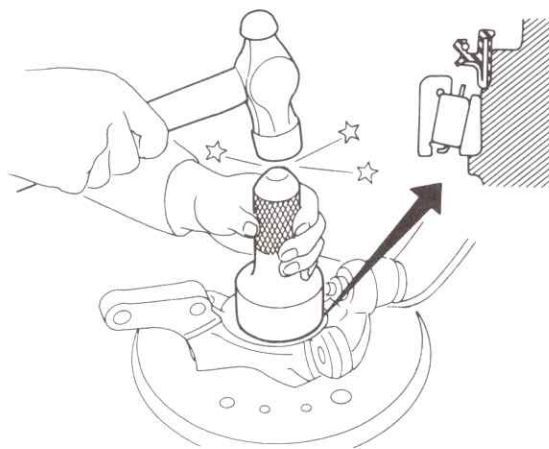


Fig. 10.12 Installing the inner bearing (Note the inset which shows fitment of grease seal) (Sec 5)

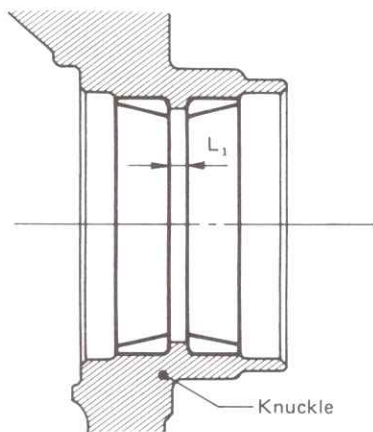


Fig. 10.13 Measuring the distance between the two inner faces of the bearings (Sec 5)

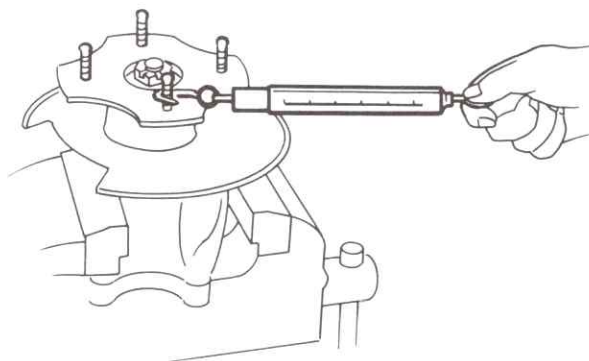


Fig. 10.14 Measuring the torque required to turn wheel hub (Sec 5)

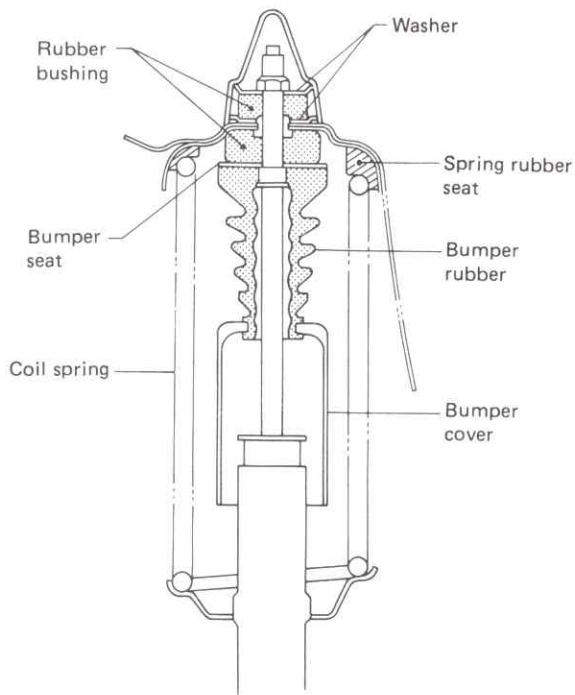


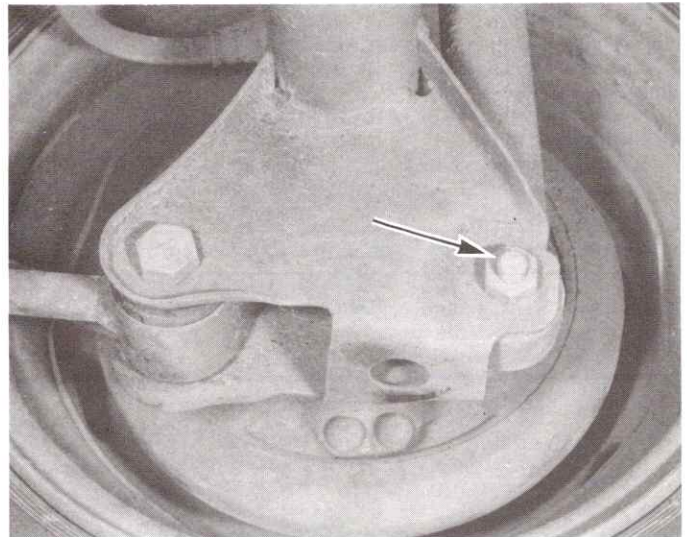
Fig. 10.15 Orientation of rear shock absorber components (Sec 6)

#### 6 Rear shock absorber – removal and refitting

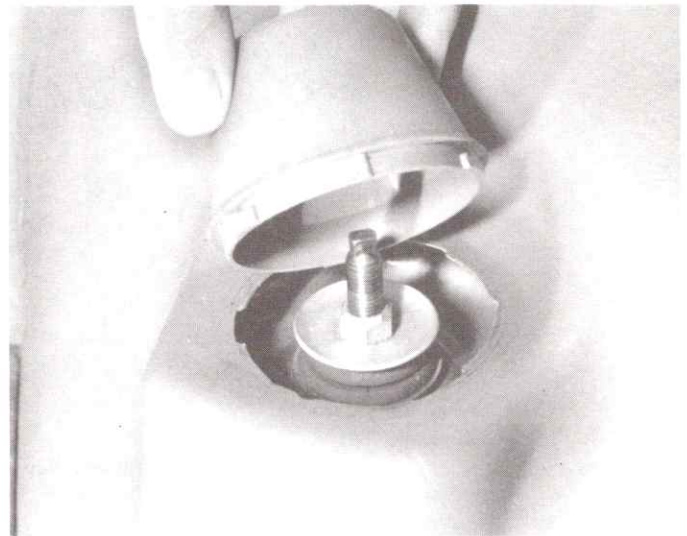
- 1 Support the rear of the vehicle on axle stands placed under the side-members.
- 2 Gently jack up the axle tube with a jack positioned under the shock absorber lower mounting, until the weight of the axle is just supported.
- 3 Remove the nut and bolt from the lower mounting bracket (photo).
- 4 From inside the luggage compartment, remove the plastic dome (it is a bayonet type fix) to expose the top mounting (photo). Undo the nut and remove the washer and rubber bushing.
- 5 Lower the jack from under the lower mounting, at the same time supporting the suspension unit. When it comes free remove it from the vehicle.
- 6 Inspect the coil spring for cracks or deformation, and all rubber parts for hardening or cracking and general wear.
- 7 Check the shock absorber for leaks and damage, ensuring it is not bent.
- 8 Refit the shock absorber assembly in the reverse order, making sure all parts of the assembly locate correctly with each other.
- 9 Finally tighten the nuts and bolts to their specified torque.

#### 7 Rear axle tube – removal and refitting

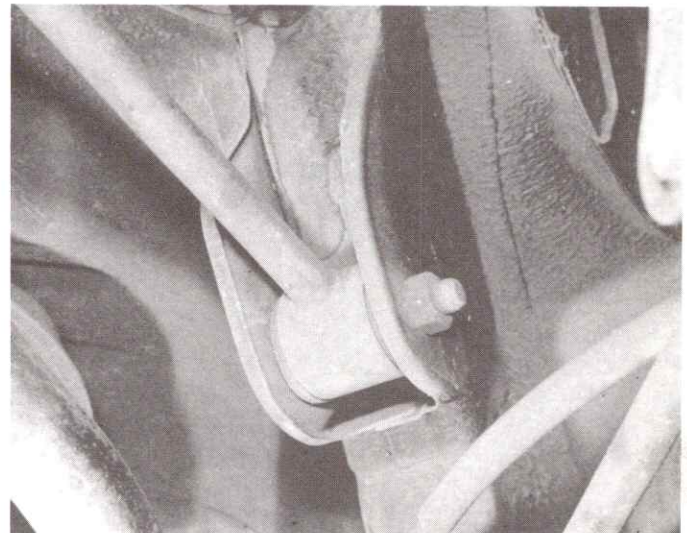
- 1 Raise the rear of the vehicle and support it on axle stands placed under the side-members.
- 2 Remove the roadwheels.
- 3 Remove the shock absorbers from both sides as described in Section 6.
- 4 Remove the rear brake drum and brake assembly as described in Chapter 9, and disconnect the hydraulic brake lines and handbrake cable.
- 5 Leave the backplates attached, and protect the stub axles from damage during the removal operation. If the threads of the stub axle are damaged, the whole axle must be renewed.
- 6 Support the axle at both ends, then undo the bolts securing the axle to the upper and lower transverse links (photo).



6.3 Lower mounting bracket on rear shock absorber (mounting bolt arrowed)



6.4 Top mounting of rear shock absorber



7.6 Typical transverse link mounting

- 7 Lower the axle and remove it from under the vehicle.
- 8 Inspect the axle for obvious signs of damage and for cracks, especially around the welded brackets for the transverse links.
- 9 Inspect the bushes of the transverse links, renewing any that are worn or perished.
- 10 Inspect the transverse links for any signs of bending.
- 11 Inspect the stub axles.
- 12 Refitting the axle is a reversal of this procedure. Refer to Chapter 9 for reassembly of, and bleeding the brake system.

### 8 Rear wheel bearings – removal and refitting

- 1 Raise the vehicle onto axle stands positioned under the side-members, and remove the rear wheels.

- 2 Remove the grease cap (photo), the split pin and nut retainer, and undo the nut.
- 3 The spacer and outer bearing race may now be lifted out (photo), or if it is stuck it will come out as the drum is removed. Be ready to catch the bearing.
- 4 With the drum removed if necessary, the brake back plate may be removed by disconnecting the hydraulic lines and handbrake cable and removing the four bolts securing the back plate to the axle (photo).
- 5 The inner bearing race will still be located in the drum. Remove the inner grease seal by prising it out then support the drum on blocks and tap out the inner bearing, using the cut outs in the drum.
- 6 Inspect the bearings for cracking, pitting, 'rattle', roughness or out of round and renew as necessary. The bearings should always be renewed as a pair, inner and outer.

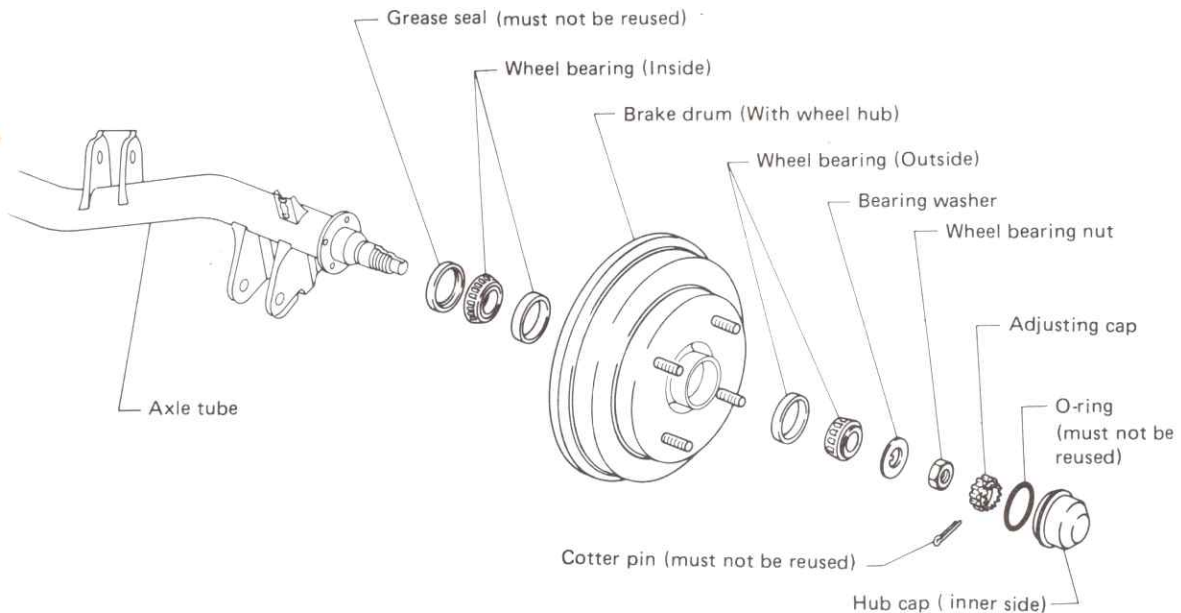


Fig. 10.16 Exploded view of rear hub assembly (Sec 8)

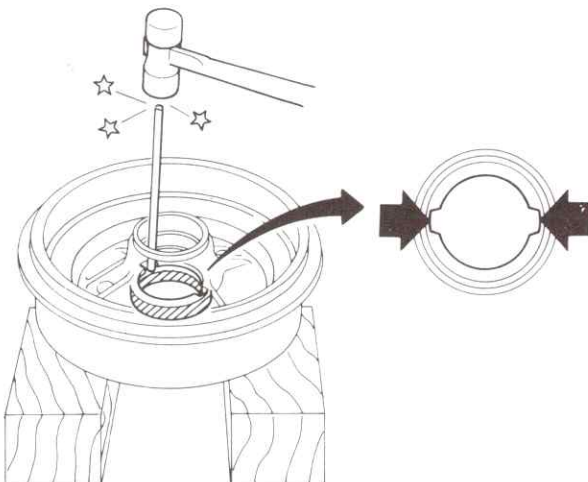
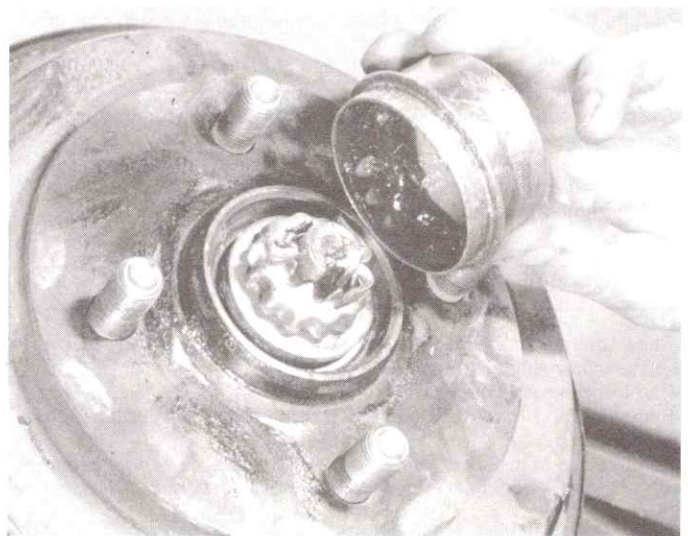
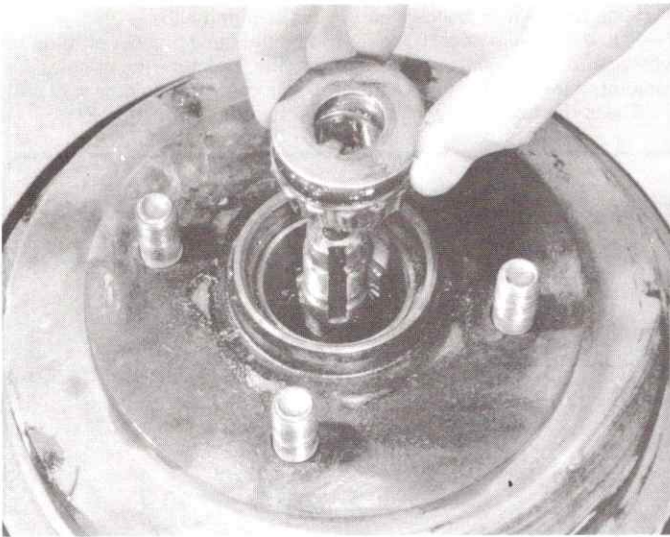


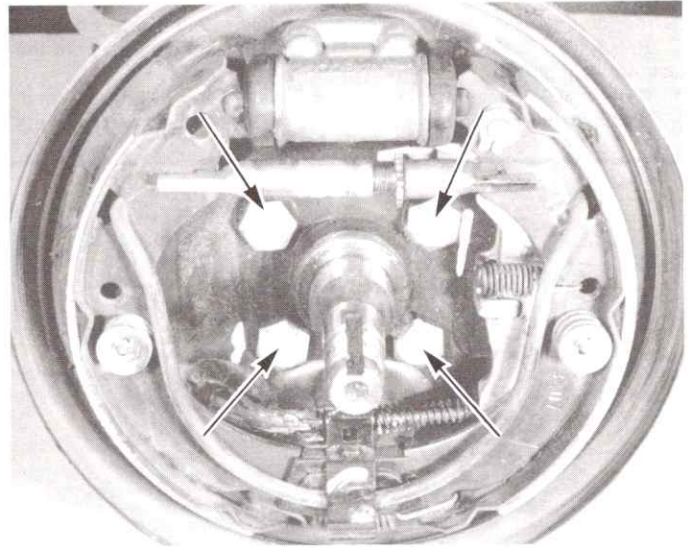
Fig. 10.17 Removing the rear bearings (Sec 8)



8.2 Removing the grease cap from the rear hub ...



8.3 ... and the spacer and taper bearing



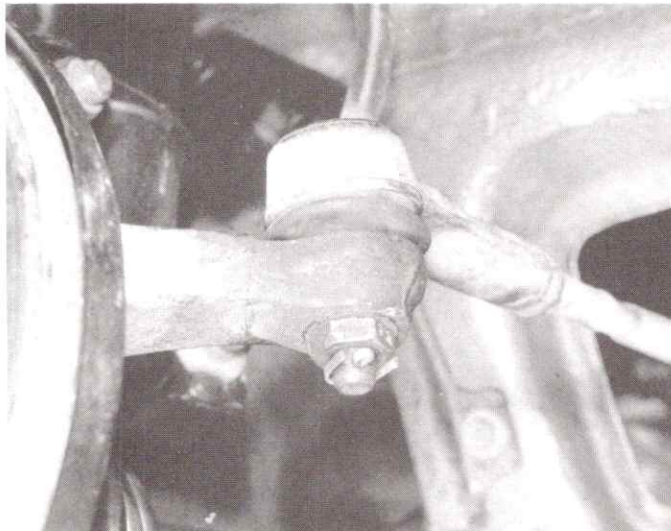
8.4 Brake backplate mounting bolts

- 7 Inspect the drum for cracks and scoring. Refer to Chapter 9, Specifications for resurfacing tolerances.
- 8 As examined before, if there are any defects in the stub axle, the whole axle tube will have to be replaced.
- 9 Press new bearings into the drum using a mandrel of suitable size.
- 10 Fit a new inner bearing, coating each liberally with high melting point lithium based grease.
- 11 Install the drum, then the outer bearing and washer, followed by the nut, finger tight only until the adjustment procedure described in Section 9 has been carried out.
- 12 Complete reassembly, connecting up the brake line and cable if they were removed. Bleed the rear brakes with reference to Chapter 9.
- 13 When installing the grease cap, always use a new O-ring seal.
- 14 Refit the roadwheels and remove the vehicle from the axle stands.

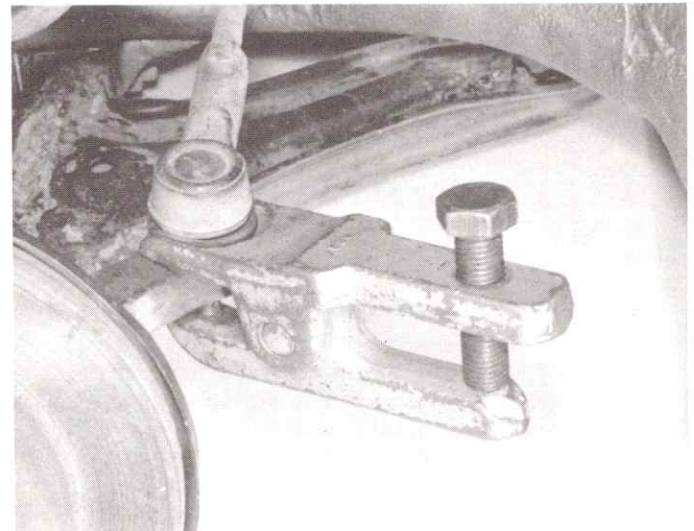
- 4 Turn the hub in both directions several times to seat the bearings.
- 5 Re-tighten the wheel bearing nut to the specified torque.
- 6 Loosen the nut through 90°.
- 7 Fit the nut retainer, aligning the split pin holes. It is permissible to tighten the wheel hub nut by as much as 15° to achieve this. **Caution:** *do not overtighten, or wheel bearing seizure may occur.*
- 8 Check that the drum/hub turns smoothly without drag. There must be no endfloat. If there is, and the adjustment has been made correctly, suspect worn bearings.
- 9 Bend the ends of the split pin around the nut retainer.
- 10 Fill the grease cap one third full with multi-purpose grease, check that the O-ring is in good condition and tap the cup squarely into position.

## 9 Rear wheel bearings – adjustment

- 1 Raise the vehicle onto axle stands placed under the side-members, and remove the rear wheels.
- 2 Remove the grease cap and split pin and nut retainer.
- 3 Tighten the wheel hub nut to the prescribed torque.



10.2A Steering rod balljoint split pin and nut



10.2B Using a balljoint separator

## 10 Steering rack bellows – renewal

- 1 The steering rack bellows should be inspected periodically for splits. Have an assistant turn the steering to full lock while doing this, otherwise the split will not be immediately apparent.
- 2 Unscrew the nut from the balljoint taper pin and, using an extractor, separate the balljoint from the eye of the steering arm (photos).

- 3 Release the locknut and then unscrew the balljoint from the tie-rod, counting the number of turns required to remove it (photo).
- 4 Release the bellows securing clips and pull the bellows from the rack housing and off the tie-rod (photo).
- 5 If the bellows have been split for some time and dirt has entered, wipe away all the old lubricant and smear the rack (extended) and the

rack end balljoint with a suitable grease.

- 6 Slide on the new bellows and fit the securing clips.

- 7 Screw the balljoint onto the tie-rod by the same number of turns as was recorded at removal and tighten the locknut. Reconnect the balljoint to the steering arm of the stub axle carrier, use a new split pin.

- 8 Check the front wheel alignment by referring to Section 21.

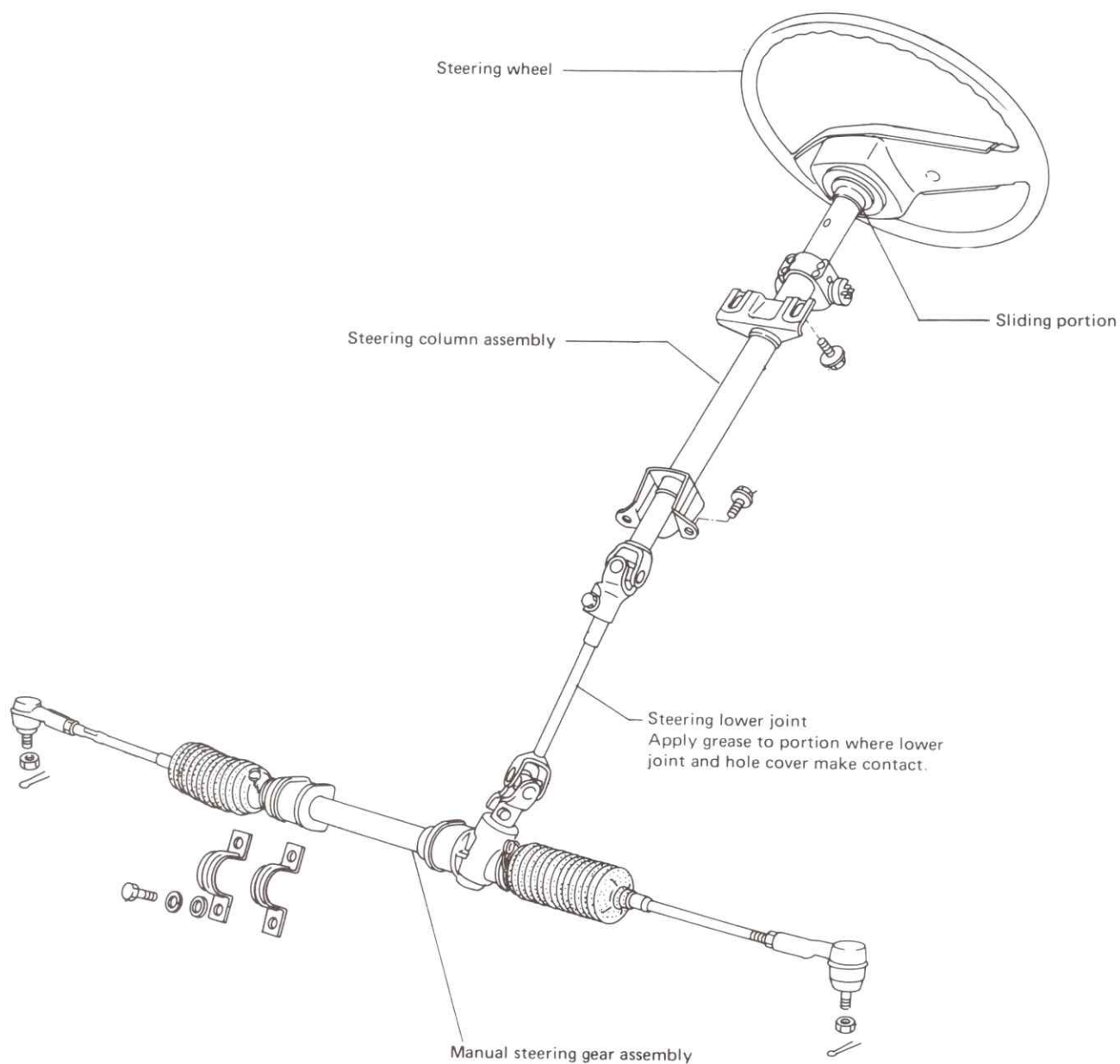
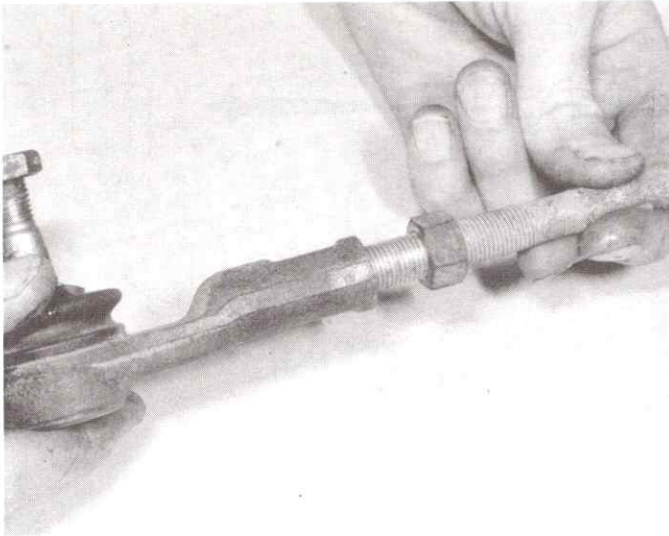
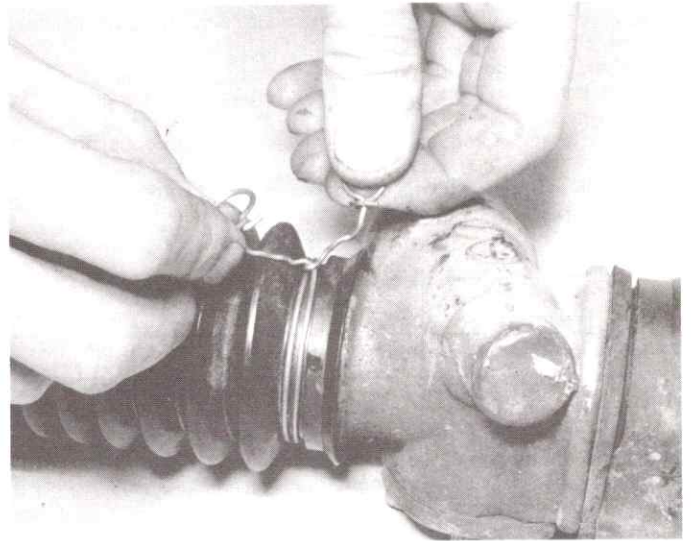


Fig. 10.18 Manual steering column and rack (Sec 10)



10.3 Removing the balljoint from the steering rod



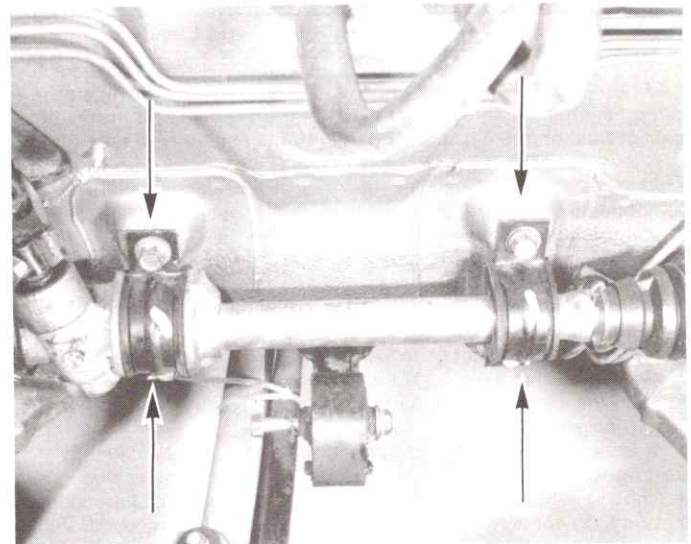
10.4 Bellows securing clips

### 11 Manual steering rack – removal and refitting

- 1 Raise the front of the vehicle and support it securely using axle stands under the side-members. Apply the handbrake and remove the front roadwheels.
- 2 Disconnect both tie-rod balljoints from the steering arms on the knuckles.
- 3 Remove the steering shaft lower joint, as described in Section 18.
- 4 Unscrew the rack housing mounting nuts and lift the steering gear from the bulkhead (photo).
- 5 Refitting is a reversal of removal.
- 6 Tighten all nuts and bolts to the specified torques, and finally check the front wheel alignment as described in Section 21.

### 12 Power-assisted steering gear – removal and refitting

- 1 Raise the front of the vehicle and support it on axle stands by the side-members. Apply the handbrake and remove the front roadwheels.
- 2 Disconnect the hydraulic hose clamp at the pinion housing on the steering gear to provide access to the union nut on the pipeline. Unscrew the union nut and allow the fluid to drain into a suitable container.
- 3 Extract the split pins and unscrew the castellated nuts from the tie-rod end balljoints. With a suitable tool, disconnect the balljoints from the steering arms on the knuckles.
- 4 Support the transmission on a jack with a block of wood as an insulator.
- 5 Disconnect the exhaust downpipe from the manifold and also disconnect the exhaust system bracket just ahead of the steering gear.
- 6 Unbolt and remove the engine rear mounting.
- 7 Unscrew and remove the bolts from the steering gear mounting clamps.
- 8 Remove the steering shaft lower joint, as described in Section 18.
- 9 Withdraw the steering gear from under the front wing, moving it in the direction of the arrow as shown in the diagram (Fig. 10.19).
- 10 Refitting is a reversal of removal.
- 11 Fill and bleed the system, as described in Section 15 and finally check the front wheel alignment as described in Section 21.



11.4 Steering rack mounting bolts (arrowed)

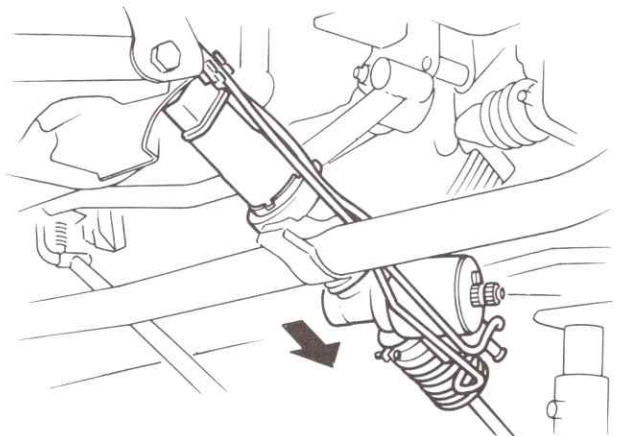


Fig. 10.19 Removing a power-assisted steering rack (Sec 12)

### 13 Power-assisted steering pump – removal and refitting

- 1 Release the pump drivebelt adjuster link lockbolt and turn the adjuster bolt to release the tension on the belt. Slip the belt from the pulleys.

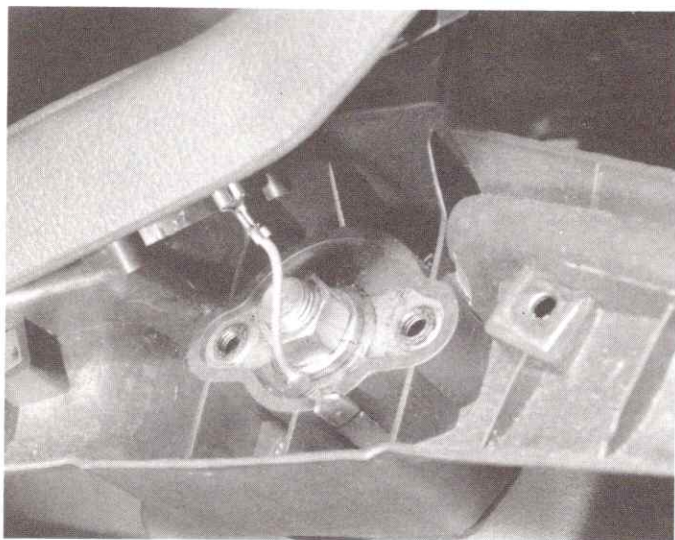
- 2 Disconnect the pressure hose from the pump by unscrewing the banjo union bolt. Allow the fluid to drain into a suitable container.
- 3 Take off the return hose clamp.
- 4 Unbolt and remove the pump.
- 5 If the connecting lines are to be removed, unscrew the union nuts and hose clips.
- 6 Refitting and reconnection are reversals of disconnection and removal.
- 7 Tension the pump drivebelt, as described in Chapter 2.
- 8 Fill and bleed the system, as described in Section 15.

#### 14 Steering gear – overhaul

- 1 It is not recommended that the manual or power-assisted steering gear or the power steering pump are overhauled.
- 2 Due to the precise nature of the assembly work and the need for special tools for measuring turning torque, it is preferable to purchase a new or factory-reconditioned unit when the original one becomes worn or develops a fault.

#### 15 Power-assisted steering – fluid level and bleeding

- 1 At the intervals specified in Section 2 unscrew the power steering pump filler cap when the engine and pump are cold and observe the level of fluid on the dipstick. Add fluid of the correct type to bring the fluid level between the low and high marks.
- 2 If the system pipelines have been disconnected or new components fitted then, after reassembly, the system must be bled.
- 3 Fill the pump reservoir with fluid.
- 4 Raise the front of the vehicle until the roadwheels are off the floor.
- 5 Turn the steering from lock to lock ten times and then top up the fluid in the reservoir so that it is at the correct level on the dipstick.
- 6 Start the engine and turn the steering wheel to left and right lock until the fluid becomes hot to touch (60 to 80°C – 140 to 176°F).
- 7 Switch off the engine and top up the reservoir, if necessary.
- 8 Start the engine and run for five seconds. Switch off and top up the fluid, if necessary.
- 9 If air is still present in the system, which will be indicated by the steering wheel being stiff to turn, repeat the operations as previously described. When turning the steering from lock to lock during bleeding, do not hold it at full lock for more than fifteen seconds while the engine is running.



16.2 Removing the steering wheel cover. Note the horn wire

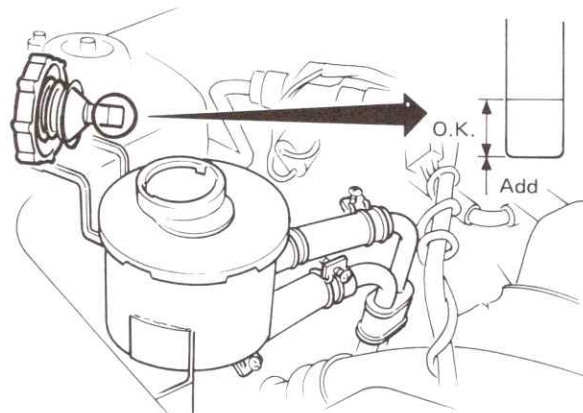


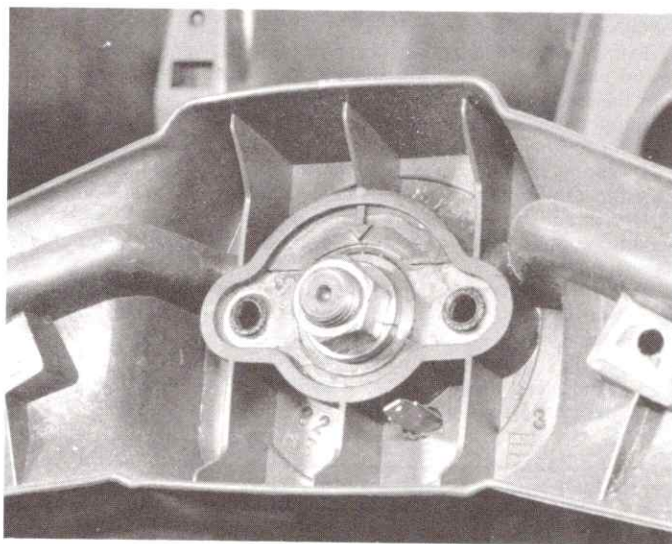
Fig. 10.20 Checking power-assisted steering fluid level (Sec 15)

#### 16 Steering wheel – removal and refitting

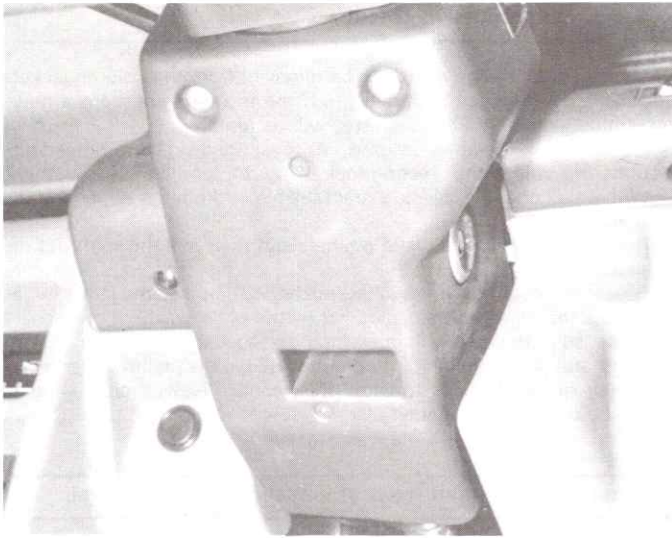
- 1 Set the front roadwheels in the straight-ahead position, disconnect the battery.
- 2 Pull the cover from the centre of the steering wheel by gripping the top of it. If the cover has not been removed since new it will require a firm pull to remove it (photo). Disconnect the horn wire.
- 3 Hold the steering wheel stationary and unscrew the retaining nut (photo).
- 4 Mark the steering wheel in relation to the inner column then remove it. If anything more than a gentle thump with the palms of the hands is required to remove the wheel from the splined steering shaft, a puller will have to be used. Tapped holes are incorporated in the steering wheel hub for attaching a puller.
- 5 Apply a little grease to the shaft splines and petroleum jelly to the horn contact ring before refitting the steering wheel. Make sure that the previously made marks are correctly aligned. Tighten the nut to the specified torque.
- 6 Refit the cover and re-connect the battery lead.

#### 17 Steering lock – removal and refitting

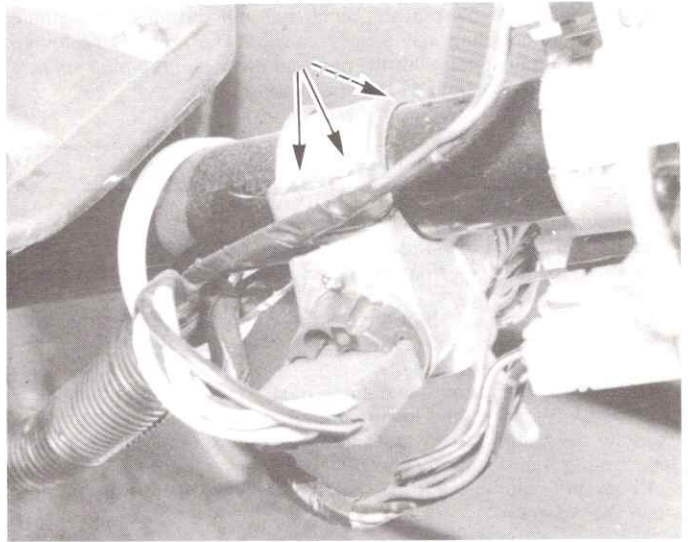
- 1 Remove the steering wheel as described in Section 16.
- 2 Remove the column shrouds (photo).



16.3 Steering wheel retaining nut



17.2 Steering column shrouds



17.4 Steering column lock securing screws

- 3 Disconnect the wiring from the ignition switch.
- 4 The steering lock is secured with two cross-head screws and two shear type screws (photo). Unscrew the cross-head screws and drill out the shear type screws. Remove the steering lock.
- 5 To refit the lock align it with the hole in the outer column, locate the clamp plate, and insert the screws finger tight.
- 6 Check that the lock operates correctly then tighten the cross-head screws and tighten the shear type screws until the heads break off.
- 7 Re-connect the wiring then refit the shrouds and steering wheel.

### 18 Steering shaft lower joint – removal and refitting

- 1 To provide better access remove the steering column aperture dust excluding cover from the bulkhead. Set the steering in the straight-ahead position.
- 2 Unscrew the pinch-bolts from both universally-jointed couplings, prise the jaws of the couplings open just enough to be able to withdraw the lower joint from the upper coupling and then from the steering gear pinion shaft (photos).

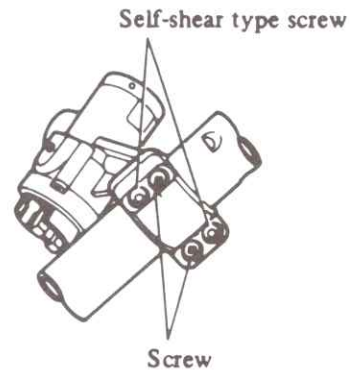
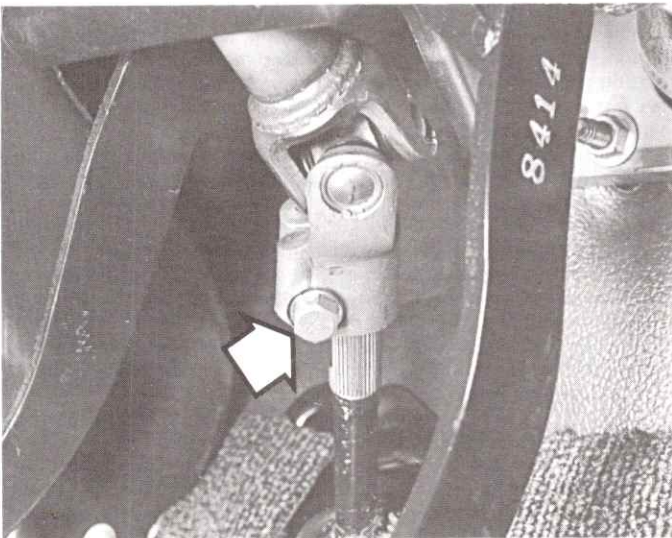
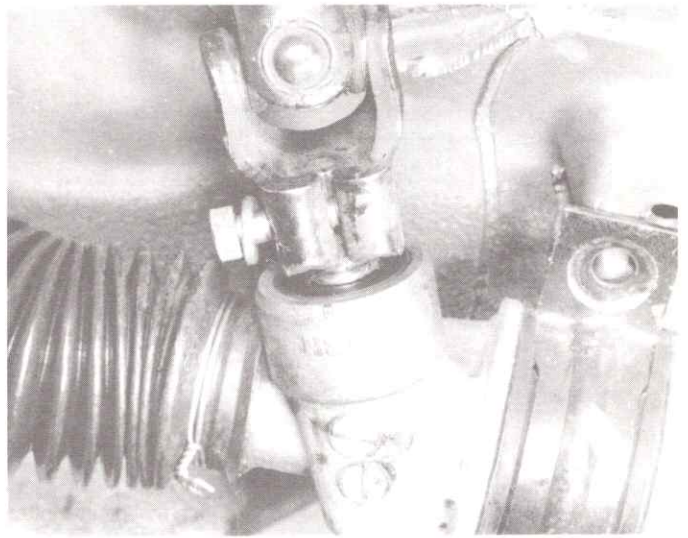


Fig. 10.21 Correct location of steering column lock screws (Sec 17)



18.2A Steering column lower pinion bolt (arrowed)

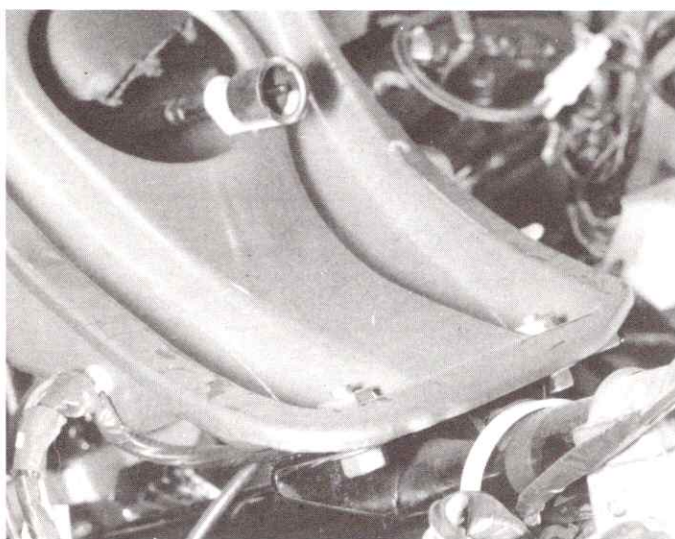


18.2B Undoing the pinch-bolt on steering gear input pinion

- 3 When refitting the joint, connect it first to the upper coupling and then to the pinion. Note that the pinch-bolt cut-out must be aligned with the upper coupling clamp jaws and that the jaws of the lower coupling must be aligned with the mark on the steering pinion spacer.
- 4 Tighten the pinch-bolts to the specified torque.

### 19 Steering column – removal and refitting

- 1 Remove the steering wheel (Section 16).
- 2 Remove the shaft lower joint (Section 18).
- 3 Remove the shrouds from the upper steering column. Disconnect the battery.
- 4 Extract the screws, disconnect the wiring harness plugs and remove the steering column switch.
- 5 Remove the heater ducts.
- 6 Remove the nuts from the column dust excluder on the bulkhead.
- 7 Unscrew the upper and lower column mounting bracket bolts and withdraw the column from under the fascia panel. Recover the spacer plates noting their location (photo).
- 8 Check the column length L (Fig. 10.22). If it does not conform, renew the assembly.



19.7 Steering column upper mounting bracket bolts

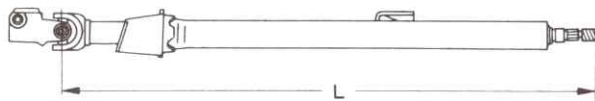


Fig. 10.22 Steering column length (Sec 19)

$L = 22.57 \text{ to } 22.63 \text{ in (573.2 to 574.8 mm)}$

#### Refitting

- 9 Offer the column into position making sure that the sliding plates are correctly located. Fit the bolts finger tight at this stage.
- 10 Fit the lower joint (Section 18), again leaving the pinch-bolts finger tight.
- 11 Check that none of the brackets or couplings are under stress and then tighten the column bolts to the specified torque.

### 20 Steering column – overhaul

- 1 The steering column shaft can be removed from the column jacket tube if the bearings require greasing. If the bearings are worn a new jacket tube, complete with bearings, will be required.
- 2 Remove the steering column, as described in the preceding Section, and unlock the steering lock using the ignition key.
- 3 With a pair of circlip pliers, extract the circlip from the upper end of the column.
- 4 Remove the plain and wave washers and then pull the shaft out of the jacket tube.
- 5 Grease the bearings and bushes, push the shaft into the jacket tube and locate the wave washer followed by the plain washer.
- 6 Make sure that the circlip which is located below the upper bearings, and the one which is to be fitted above the plain washer both have their rounded edges towards the bearing. New circlips should always be used at reassembly.

### 21 Steering angles and front wheel alignment – general

- 1 Accurate front wheel alignment is essential to good steering and for even tyre wear. Before considering the steering angles, check that the tyres are correctly inflated, that the front wheels are not buckled, the hub bearings are not worn and that the steering linkage is in good order, without slackness or wear at the joints.

- 2 Wheel alignment consists of four factors:

*Camber*, is the angle at which the roadwheels are set from the vertical when viewed from the front or rear of the vehicle. Positive camber is the angle (in degrees) that the wheels are tilted outwards at the top from the vertical.

*Castor*, is the angle between the steering axis and a vertical line when viewed from each side of the vehicle. Positive castor is indicated when the steering axis is inclined towards the rear of the vehicle at its upper end.

*Steering axis inclination*, is the angle, when viewed from the front or rear of the vehicle, between the vertical and an imaginary line drawn between the upper and lower front suspension strut mountings.

*Toe* is the amount by which the distance between the front inside edges on the roadwheel rim differs from that between the rear inside edges. If the distance between the front edges is less than that at the rear, the wheels are said to toe-in. If the distance between the front inside edges is greater than that at the rear, the wheels toe-out.

- 3 Owing to the need for precision gauges to measure the small angles of the steering and suspension settings, it is preferable that checking of camber and castor is left to a service station having the necessary equipment. Camber and castor are set during production of the vehicle, and any deviation from the specified angle will be due to accident damage or gross wear in the suspension mountings.

- 4 To check the front wheel alignment, first make sure that the lengths of both tie-rods are equal when the steering is in the straight-ahead position. The tie-rod lengths can be adjusted for length if necessary by releasing the locknuts from the balljoint ends and rotating the rods. Flats are provided on the rods in order to hold them still with an open-ended spanner when the locknut is undone.

- 5 Obtain a tracking gauge. These are available in various forms from accessory stores, or one can be fabricated from a length of steel tubing suitably cranked to clear the sump and bellhousing and having a setscrew and locknut at one end.

- 6 With the gauge, measure the distances between the two wheel inner rims (at hub height) at the rear of the wheel. Push the vehicle forward to rotate the wheel through  $180^\circ$  (half a turn) and measure the distance between the wheel inner rims, again at hub height, at the front of the wheel. This last measurement should differ from the first by the appropriate toe-in which is given in the Specifications. The vehicle must be on level ground.

- 7 Where the toe-in is found to be incorrect, release the tie-rod balljoint locknut and turn the tie-rods equally. Only turn them a quarter of a turn at a time before re-checking the alignment. Do not grip the threaded part of the tie-rod during adjustment, but use an open-ended spanner on the flats provided. It is important not to allow the tie-rods to become unequal in length during adjustment, otherwise the alignment of the steering wheel will become incorrect and tyre scrubbing will occur on turns.

8 On completion, tighten the locknuts without disturbing the setting. Check that the balljoint is at the centre of its arc of travel.

## 22 Wheels and tyres – general care and maintenance

1 Wheels and tyres should give no real problems in use provided that a close eye is kept on them with regard to excessive wear or damage. To this end, the following points should be noted.

2 Ensure that tyre pressures are checked regularly and maintained correctly. Checking should be carried out with the tyres cold and not immediately after the vehicle has been in use. If the pressures are checked with the tyres hot, an apparently high reading will be obtained owing to heat expansion. Under no circumstances should an attempt be made to reduce the pressures to the quoted cold reading in this instance, or effective underinflation will result.

3 Underinflation will cause overheating of the tyre owing to excessive flexing of the casing, and the tread will not sit correctly on the road surface. This will cause a consequent loss of adhesion and excessive wear, not to mention the danger of sudden tyre failure due to heat build-up.

4 Overinflation will cause rapid wear of the centre part of the tyre tread coupled with reduced adhesion, harsher ride, and the danger of shock damage occurring in the tyre casing.

5 Regularly check the tyres for damage in the form of cuts or bulges, especially in the sidewalls. Remove any nails or stones embedded in the tread before they penetrate the tyre to cause deflation. If removal of a nail *does* reveal that the tyre has been punctured, refit the nail so that its point of penetration is marked. Then immediately change the wheel and have the tyre repaired by a tyre dealer. Do *not* drive on a tyre in such a condition. In many cases a puncture can be simply repaired by the use of an inner tube of the correct size and type. If in any doubt as to the possible consequences of any damage found, consult your local tyre dealer for advice.

6 Periodically remove the wheels and clean any dirt or mud from the inside and outside surfaces. Examine the wheel rims for signs of rusting, corrosion or other damage. Light alloy wheels are easily damaged by 'kerbing' whilst parking, and similarly steel wheels may become dented or buckled. Renewal of the wheel is very often the only

course of remedial action possible.

7 The balance of each wheel and tyre assembly should be maintained to avoid excessive wear, not only to the tyres but also to the steering and suspension components. Wheel imbalance is normally signified by vibration through the vehicle's bodyshell, although in many cases it is particularly noticeable through the steering wheel. Conversely, it should be noted that wear or damage in suspension or steering components may cause excessive tyre wear. Out-of-round or out-of-true tyres, damaged wheels and wheel bearing wear/maladjustment also fall into this category. Balancing will not usually cure vibration caused by such wear.

8 Wheel balancing may be carried out with the wheel either on or off the vehicle. If balanced on the vehicle, ensure that the wheel-to-hub relationship is marked in some way prior to subsequent wheel removal so that it may be refitted in its original position.

9 General tyre wear is influenced to a large degree by driving style – harsh braking and acceleration or fast cornering will all produce more rapid tyre wear. Interchanging of tyres may result in more even wear, but this should only be carried out where there is no mix of tyre types on the vehicle. However, it is worth bearing in mind that if this is completely effective, the added expense of replacing a complete set of tyres simultaneously is incurred, which may prove financially restrictive for many owners.

10 Front tyres may wear unevenly as a result of wheel misalignment. The front wheels should always be correctly aligned according to the settings specified by the vehicle manufacturer.

11 Legal restrictions apply to the mixing of tyre types on a vehicle. Basically this means that a vehicle must not have tyres of differing construction on the same axle. Although it is not recommended to mix tyre types between front axle and rear axle, the only legally permissible combination is crossply at the front and radial at the rear. When mixing radial ply tyres, textile braced radials must always go on the front axle, with steel braced radials at the rear. An obvious disadvantage of such mixing is the necessity to carry two spare tyres to avoid contravening the law in the event of a puncture.

12 In the UK, the Motor Vehicles Construction and Use Regulations apply to many aspects of tyre fitting and usage. It is suggested that a copy of these regulations is obtained from your local police if in doubt as to the current legal requirements with regard to tyre condition, minimum tread depth, etc.

## 23 Fault diagnosis – suspension and steering

Symptom	Reason(s)
<i>Front suspension</i>	
Vehicle wanders	Incorrect wheel alignment Worn transverse link balljoints
Heavy or stiff steering	Incorrect front wheel alignment Incorrect tyre pressures
Wheel wobble or vibration	Roadwheels out of balance Roadwheel buckled Incorrect front wheel alignment Faulty strut Weak coil spring
Excessive pitching or rolling on corner or during braking	Faulty strut Weak or broken coil spring
Tyre squeal when cornering	Incorrect front wheel alignment Incorrect tyre pressures
Abnormal tyre wear	Incorrect tyre pressures Incorrect front wheel alignment Worn hub bearing
<i>Rear suspension</i>	
Poor roadholding and wander	Faulty shock absorber Weak coil spring Worn or incorrectly adjusted hub bearing Worn bushes on link mountings
<i>Manual steering gear</i>	
Stiff action	Lack of rack lubrication Seized tie-rod end balljoint Seized suspension lower balljoint (transverse link)
Free movement at steering wheel	Wear in tie-rod balljoint Wear in rack teeth
Knocking when traversing uneven surface	Incorrectly adjusted rack slipper
<i>Power-assisted steering gear</i>	
<i>The symptoms and reasons applicable to manual steering gear will apply, plus the following:</i>	
Stiff action or no return action	Slipping pump drivebelt Air in fluid Steering column out of alignment Castor angle incorrect due to damage or gross wear in bushes and mountings
Steering effort on both locks unequal	Leaking seal in steering gear Clogged fluid passage within gear assembly
Noisy pump	Loose pulley Kinked hose Clogged filter in fluid reservoir Low fluid level

# Chapter 11 Bodywork and fittings

*For modifications, and information applicable to later models, see Supplement at end of manual*

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## 1 General description

The bodywork on all Micra models is of a unitary welded steel construction, with an emphasis on weight saving.

The whole bodyshell is dipped against corrosion.

All models in the range are well equipped, and all the usual optional extras are available.

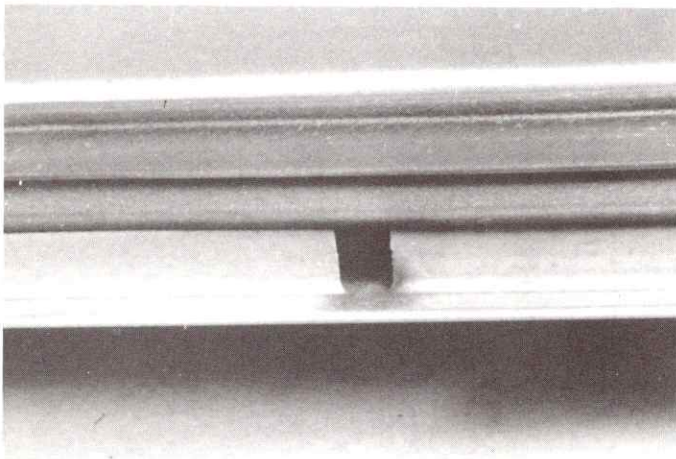
## 2 Maintenance – bodywork and underframe

1 The general condition of a vehicle's bodywork is the one thing that significantly affects its value. Maintenance is easy but needs to be regular. Neglect, particularly after minor damage, can lead quickly to further deterioration and costly repair bills. It is important also to keep watch on those parts of the vehicle not immediately visible, for

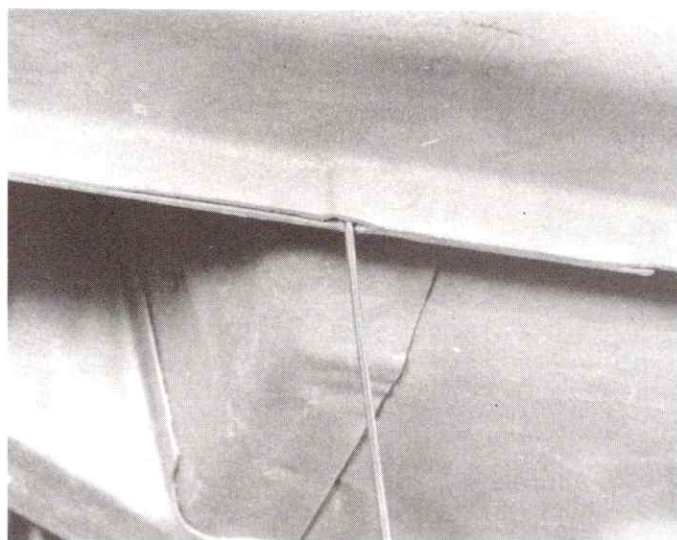
instance the underside, inside all the wheel arches and the lower part of the engine compartment.

2 The basic maintenance routine for the bodywork is washing – preferably with a lot of water, from a hose. This will remove all the loose solids which may have stuck to the vehicle. It is important to flush these off in such a way as to prevent grit from scratching the finish. The wheel arches and underframe need washing in the same way to remove any accumulated mud which will retain moisture and tend to encourage rust. Paradoxically enough, the best time to clean the underframe and wheel arches is in wet weather when the mud is thoroughly wet and soft. In very wet weather the underframe is usually cleaned of large accumulations automatically and this is a good time for inspection.

3 Periodically, except on vehicles with a wax-based underbody protective coating, it is a good idea to have the whole of the underframe of the vehicle steam cleaned, engine compartment included, so that a thorough inspection can be carried out to see what



2.4A Drain hole in underside of door



2.4B Clearing a drain hole in the sill

minor repairs and renovations are necessary. Steam cleaning is available at many garages and is necessary for removal of the accumulation of oily grime which sometimes is allowed to become thick in certain areas. If steam cleaning facilities are not available, there are one or two excellent grease solvents available which can be brush applied. The dirt can then be simply hosed off. Note that these methods should not be used on vehicles with wax-based underbody protective coating or the coating will be removed. Such vehicles should be inspected annually, preferably just prior to winter, when the underbody should be washed down and any damage to the wax coating repaired. Ideally, a completely fresh coat should be applied. It would also be worth considering the use of such wax-based protection for injection into door panels, sills, box sections, etc., as an additional safeguard against rust damage where such protection is not provided by the vehicle manufacturer.

4 After washing paintwork, wipe off with a chamois leather to give an unspotted clear finish. A coat of clear protective wax polish will give added protection against chemical pollutants in the air. If the paintwork sheen has dulled or oxidised, use a cleaner/polisher combination to restore the brilliance of the shine. This requires a little effort, but such dulling is usually caused because regular washing has been neglected. Care needs to be taken with metallic paintwork, as special non-abrasive cleaner/polisher is required to avoid damage to the finish. Always check that the door and ventilator opening drain holes and pipes are completely clear so that water can be drained out. Bright work should be treated in the same way as paint work. Windscreens and windows can be kept clear of the smeary film which often appears by the use of a proprietary glass cleaner. Never use any form of wax or other body or chromium polish on glass.

### 3 Maintenance – upholstery and carpets

Mats and carpets should be brushed or vacuum cleaned regularly to keep them free of grit. If they are badly stained remove them from the vehicle for scrubbing or sponging and make quite sure they are dry before refitting. Seats and interior trim panels can be kept clean by wiping with a damp cloth. If they do become stained (which can be more apparent on light coloured upholstery) use a little liquid detergent and a soft nail brush to scour the grime out of the grain of the material. Do not forget to keep the headlining clean in the same way as the upholstery. When using liquid cleaners inside the vehicle do not over-wet the surfaces being cleaned. Excessive damp could get into the seams and padded interior causing stains, offensive odours or even rot. If the inside of the vehicle gets wet accidentally it is worthwhile taking some trouble to dry it out properly, particularly where carpets

are involved. *Do not leave oil or electric heaters inside the vehicle for this purpose.*

### 4 Minor body damage – repair

*The photographic sequences on pages 174 and 175 illustrate the operations detailed in the following sub-sections.*

**Note:** For more detailed information about bodywork repair, the Haynes Publishing Group publish a book by Lindsay Porter called *The Car Bodywork Repair Manual*. This incorporates information on such aspects as rust treatment, painting and glass fibre repairs, as well as details on more ambitious repairs involving welding and panel beating.

#### *Repair of minor scratches in bodywork*

If the scratch is very superficial, and does not penetrate to the metal of the bodywork, repair is very simple. Lightly rub the area of the scratch with a paintwork renovator, or a very fine cutting paste, to remove loose paint from the scratch and to clear the surrounding bodywork of wax polish. Rinse the area with clean water.

Apply touch-up paint to the scratch using a fine paint brush; continue to apply fine layers of paint until the surface of the paint in the scratch is level with the surrounding paintwork. Allow the new paint at least two weeks to harden; then blend it into the surrounding paintwork by rubbing the scratch area with a paintwork renovator or a very fine cutting paste. Finally, apply wax polish.

Where the scratch has penetrated right through to the metal of the bodywork, causing the metal to rust, a different repair technique is required. Remove any loose rust from the bottom of the scratch with a penknife, then apply rust inhibiting paint to prevent the formation of rust in the future. Using a rubber or nylon applicator fill the scratch with bodystopper paste. If required, this paste can be mixed with cellulose thinners to provide a very thin paste which is ideal for filling narrow scratches. Before the stopper-paste in the scratch hardens, wrap a piece of smooth cotton rag around the top of a finger. Dip the finger in cellulose thinners and then quickly sweep it across the surface of the stopper-paste in the scratch; this will ensure that the surface of the stopper-paste is slightly hollowed. The scratch can now be painted over as described earlier in this Section.

#### *Repair of dents in bodywork*

When deep denting of the vehicle's bodywork has taken place, the first task is to pull the dent out, until the affected bodywork almost attains its original shape. There is little point in trying to restore the original shape completely, as the metal in the damaged area will have stretched on impact and cannot be reshaped fully to its original

contour. It is better to bring the level of the dent up to a point which is about  $\frac{1}{8}$  in (3 mm) below the level of the surrounding bodywork. In cases where the dent is very shallow anyway, it is not worth trying to pull it out at all. If the underside of the dent is accessible, it can be hammered out gently from behind, using a mallet with a wooden or plastic head. Whilst doing this, hold a suitable block of wood firmly against the outside of the panel to absorb the impact from the hammer blows and thus prevent a large area of the bodywork from being 'belled-out'.

Should the dent be in a section of the bodywork which has a double skin or some other factor making it inaccessible from behind, a different technique is called for. Drill several small holes through the metal inside the area – particularly in the deeper section. Then screw long self-tapping screws into the holes just sufficiently for them to gain a good purchase in the metal. Now the dent can be pulled out by pulling on the protruding heads of the screws with a pair of pliers.

The next stage of the repair is the removal of the paint from the damaged area, and from an inch or so of the surrounding 'sound' bodywork. This is accomplished most easily by using a wire brush or abrasive pad on a power drill, although it can be done just as effectively by hand using sheets of abrasive paper. To complete the preparation for filling, score the surface of the bare metal with a screwdriver or the tang of a file, or alternatively, drill small holes in the affected area. This will provide a really good 'key' for the filler paste.

To complete the repair see the Section on filling and re-spraying.

### *Repair of rust holes or gashes in bodywork*

Remove all paint from the affected area and from an inch or so of the surrounding 'sound' bodywork, using an abrasive pad or a wire brush on a power drill. If these are not available a few sheets of abrasive paper will do the job just as effectively. With the paint removed you will be able to gauge the severity of the corrosion and therefore decide whether to renew the whole panel (if this is possible) or to repair the affected area. New body panels are not as expensive as most people think and it is often quicker and more satisfactory to fit a new panel than to attempt to repair large areas of corrosion.

Remove all fittings from the affected area except those which will act as a guide to the original shape of the damaged bodywork (eg headlamp shells etc). Then, using tin snips or a hacksaw blade, remove all loose metal and any other metal badly affected by corrosion. Hammer the edges of the hole inwards in order to create a slight depression for the filler paste.

Wire brush the affected area to remove the powdery rust from the surface of the remaining metal. Paint the affected area with rust inhibiting paint; if the back of the rusted area is accessible treat this also.

Before filling can take place it will be necessary to block the hole in some way. This can be achieved by the use of aluminium or plastic mesh, or aluminium tape.

Aluminium or plastic mesh is probably the best material to use for a large hole. Cut a piece to the approximate size and shape of the hole to be filled, then position it in the hole so that its edges are below the level of the surrounding bodywork. It can be retained in position by several blobs of filler paste around its periphery.

Aluminium tape should be used for small or very narrow holes. Pull a piece off the roll and trim it to the approximate size and shape required, then pull off the backing paper (if used) and stick the tape over the hole; it can be overlapped if the thickness of one piece is insufficient. Burnish down the edges of the tape with the handle of a screwdriver or similar, to ensure that the tape is securely attached to the metal underneath.

### *Bodywork repairs – filling and re-spraying*

Before using this Section, see the Sections on dent, deep scratch, rust holes and gash repairs.

Many types of bodyfiller are available, but generally speaking those proprietary kits which contain a tin of filler paste and a tube of resin hardener are best for this type of repair. A wide, flexible plastic or nylon applicator will be found invaluable for imparting a smooth and well contoured finish to the surface of the filler.

Mix up a little filler on a clean piece of card or board – measure the hardener carefully (follow the maker's instructions on the pack) otherwise the filler will set too rapidly or too slowly. Using the applicator apply the filler paste to the prepared area; draw the applicator across the surface of the filler to achieve the correct contour

and to level the filler surface. As soon as a contour that approximates to the correct one is achieved, stop working the paste – if you carry on too long the paste will become sticky and begin to 'pick up' on the applicator. Continue to add thin layers of filler paste at twenty-minute intervals until the level of the filler is just proud of the surrounding bodywork.

Once the filler has hardened, excess can be removed using a metal plane or file. From then on, progressively finer grades of abrasive paper should be used, starting with a 40 grade production paper and finishing with 400 grade wet-and-dry paper. Always wrap the abrasive paper around a flat rubber, cork, or wooden block – otherwise the surface of the filler will not be completely flat. During the smoothing of the filler surface the wet-and-dry paper should be periodically rinsed in water. This will ensure that a very smooth finish is imparted to the filler at the final stage.

At this stage the 'dent' should be surrounded by a ring of bare metal, which in turn should be encircled by the finely 'feathered' edge of the good paintwork. Rinse the repair area with clean water, until all of the dust produced by the rubbing-down operation has gone.

Spray the whole repair area with a light coat of primer – this will show up any imperfections in the surface of the filler. Repair these imperfections with fresh filler paste or bodystopper, and once more smooth the surface with abrasive paper. If bodystopper is used, it can be mixed with cellulose thinners to form a really thin paste which is ideal for filling small holes. Repeat this spray and repair procedure until you are satisfied that the surface of the filler, and the feathered edge of the paintwork are perfect. Clean the repair area with clean water and allow to dry fully.

The repair area is now ready for final spraying. Paint spraying must be carried out in a warm, dry, windless and dust free atmosphere. This condition can be created artificially if you have access to a large indoor working area, but if you are forced to work in the open, you will have to pick your day very carefully. If you are working indoors, dousing the floor in the work area with water will help to settle the dust which would otherwise be in the atmosphere. If the repair area is confined to one body panel, mask off the surrounding panels; this will help to minimise the effects of a slight mis-match in paint colours. Bodywork fittings (eg chrome strips, door handles etc) will also need to be masked off. Use genuine masking tape and several thicknesses of newspaper for the masking operations.

Before commencing to spray, agitate the aerosol can thoroughly, then spray a test area (an old tin, or similar) until the technique is mastered. Cover the repair area with a thick coat of primer; the thickness should be built up using several thin layers of paint rather than one thick one. Using 400 grade wet-and-dry paper, rub down the surface of the primer until it is really smooth. While doing this, the work area should be thoroughly doused with water, and the wet-and-dry paper periodically rinsed in water. Allow to dry before spraying on more paint.

Spray on the top coat, again building up the thickness by using several thin layers of paint. Start spraying in the centre of the repair area and then, using a circular motion, work outwards until the whole repair area and about 2 inches of the surrounding original paintwork is covered. Remove all masking material 10 to 15 minutes after spraying on the final coat of paint.

Allow the new paint at least two weeks to harden, then, using a paintwork renovator or a very fine cutting paste, blend the edges of the paint into the existing paintwork. Finally, apply wax polish.

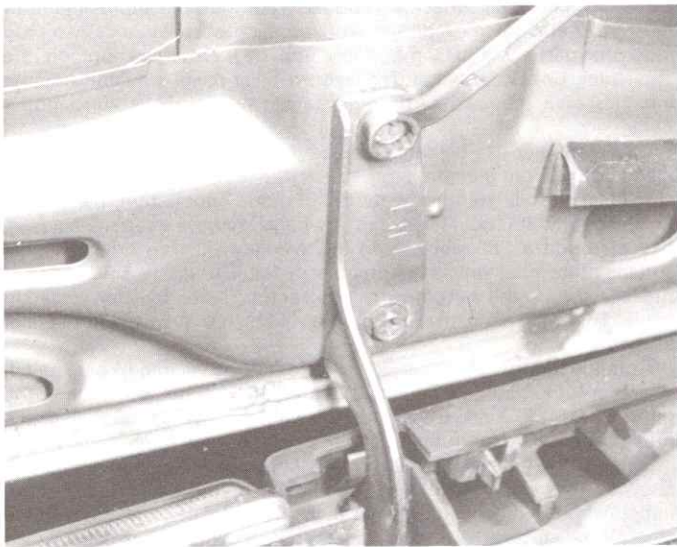
## **5 Major body damage – repair**

This should be left to your dealer or a local body repair specialist, who have the necessary body jigs and presses for realignment.

Failure to detect and straighten bent underframes can lead to poor roadholding and steering.

## **6 Bonnet – removal and refitting**

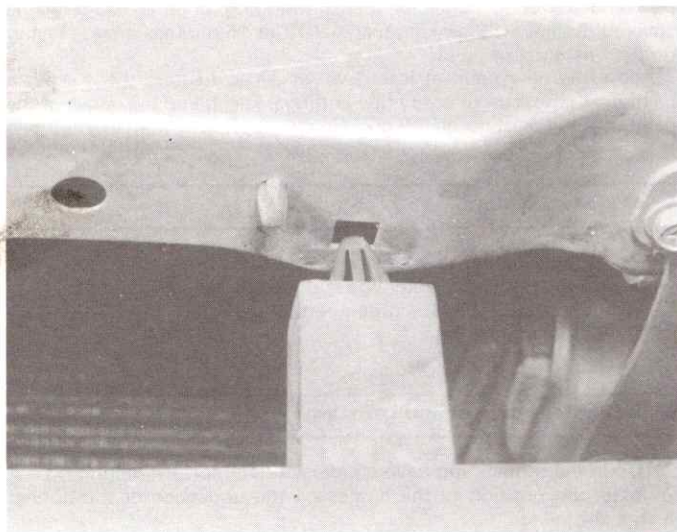
- 1 Open the bonnet and have an assistant support its weight.
- 2 Mark the position of the hinges on the underside of the bonnet with a soft pencil.
- 3 Unscrew the hinge bolts (photo) and then lift the bonnet from the vehicle.



6.3 Removing the bonnet hinge bolts



7.1 Removing the Nissan motif



7.2B ... at the top right and left side ...

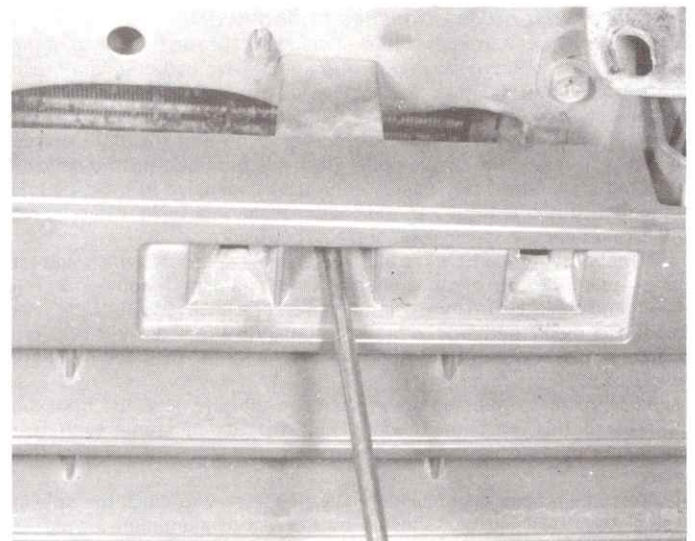
- 4 Refitting is a reversal of removal, but before fully tightening the bolts, gently close the bonnet and check its alignment. Adjust as necessary before fully tightening the bolts.
- 5 Now close the bonnet. If it does not shut smoothly and positively adjust the bonnet lock and striker, as described in Section 8.

### 7 Radiator grille – removal and refitting

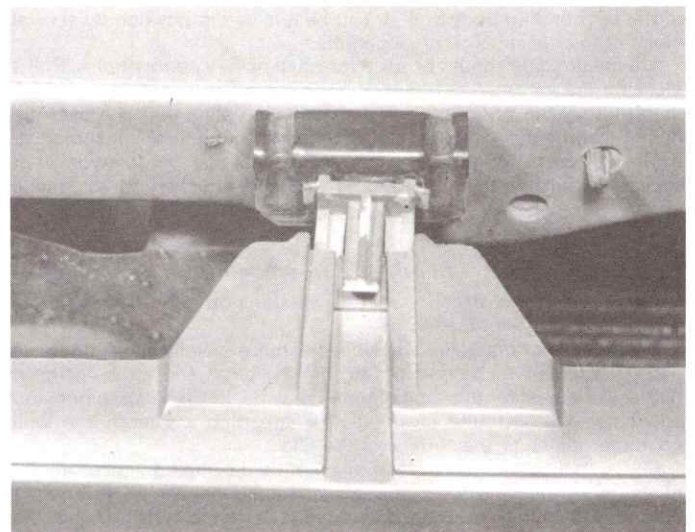
- 1 Open the bonnet and using a screwdriver prize out the 'Nissan' motif (photo).
- 2 Use the screwdriver to depress the plastic clips at the top edge of the grille. There are three of these (photos).
- 3 The bottom edge is held by locating dowels. Lift the grille out.
- 4 Refitting is a reversal of removal.

### 8 Bonnet lock and release assembly – removal, refitting and adjustment

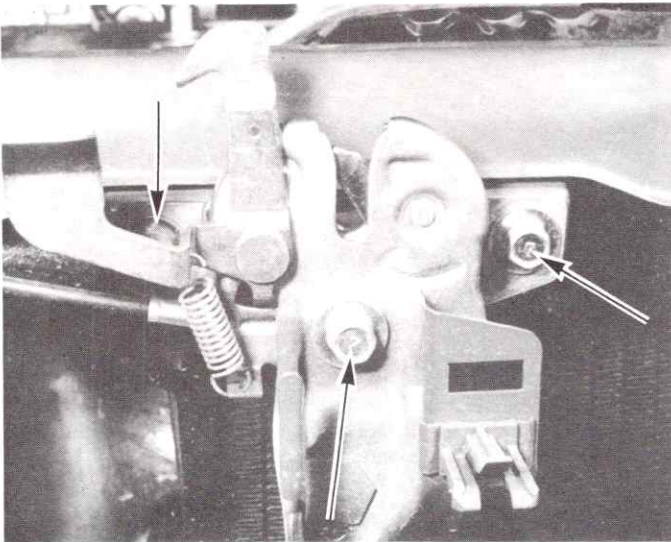
- 1 Open the bonnet and support it on its strut.
- 2 Remove the radiator grille, as described in the preceding Section.



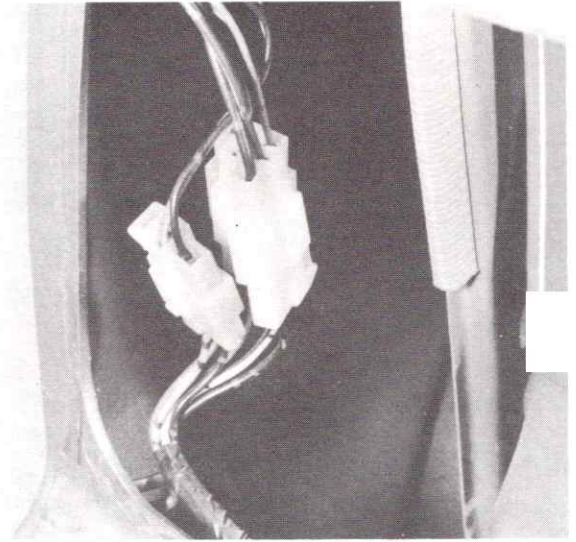
7.2A Releasing the clip ...



7.2C ... and the centre



8.3 Bonnet lock retaining bolt locations



10.1 Electrical connectors to tailgate

- 3 Unscrew the three lock retaining bolts, pull the lock from its mounting bracket and unhook the release cable from it.
- 4 The control lever and cable may be removed after unscrewing the lever fixing screws under the fascia panel and withdrawing the cable through its bulkhead grommet.
- 5 Refitting is a reversal of removal, but set the lock bolts finger tight so that when the bonnet is closed the striker enters the lock slot centrally.
- 6 \*Close the bonnet and check that there is no up and down movement when the front of the bonnet is depressed with the hand. If there is, move the lock downwards to eliminate any free play. Fully tighten the lock fixing bolts. If necessary, adjust the rubber corner stops so that the bonnet is supported firmly when shut. Apply a little grease to the lock lever end and pivot.

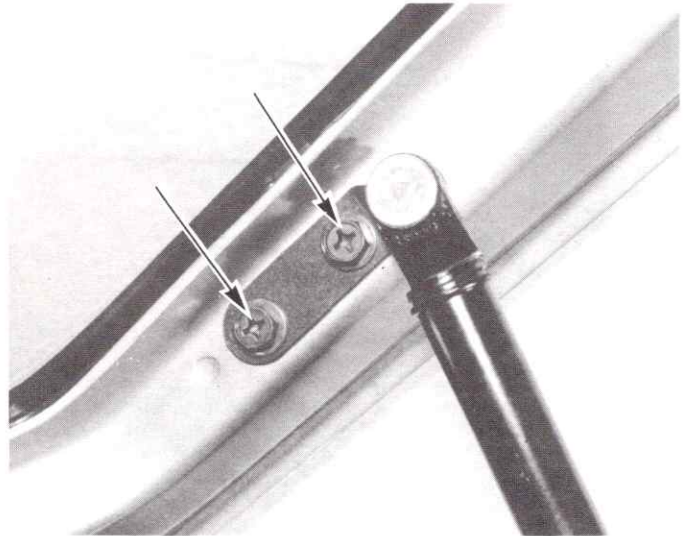
### 9 Bumpers (front and rear) – removal and refitting

- 1 The bumpers at the front and rear are bolted to the bodyshell.
- 2 To remove them, raise the front or rear of the vehicle as required, for ease of access, and support it on axle stands.
- 3 Disconnect any electrical components and then unbolt and remove the bumpers.
- 4 Refitting is a reversal of removal.

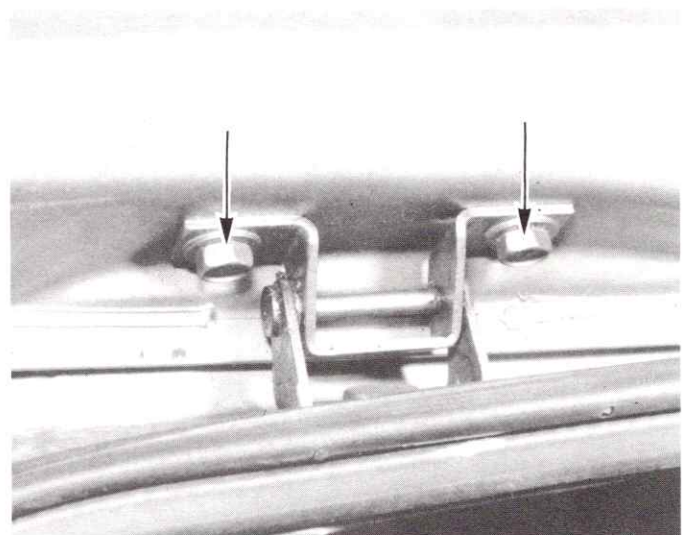
### 10 Tailgate – removal and refitting

- 1 Open the tailgate and disconnect the lead to the rear window demister. Also, disconnect the leads to the tailgate wiper motor, which are reached from behind the rear combination light, or by removing the interior trim in the luggage compartment (photo).
- 2 Remove the bolts securing the tailgate stay arms to the tailgate supporting the tailgate afterwards (photo).
- 3 To facilitate feeding the electrical cables back through the tailgate during refitting, attach a piece of string to the end of the cables before they are pulled out. The string will then be in place of the cables within the tailgate.
- 4 Remove the tailgate hinge bolts (photo).
- 5 Carefully remove the tailgate, feeding the electrical cables up and out of the left-hand pillar. Once the cables are removed, tape the ends of the string to the tailgate.
- 6 Refitting is the reverse of removal.
- 7 When refitting the tailgate, attach the string to the cables and pull them back through the tailgate cavity.

**Note:** The tailgate stays should be handled with care to prevent scratches which may cause gas leakage.



10.2 Tailgate stay bolts ...



10.4 ... and the hinge bolts



This sequence of photographs deals with the repair of the dent and paintwork damage shown in this photo. The procedure will be similar for the repair of a hole. It should be noted that the procedures given here are simplified – more explicit instructions will be found in the text



In the case of a dent the first job – after removing surrounding trim – is to hammer out the dent where access is possible. This will minimise filling. Here, the large dent having been hammered out, the damaged area is being made slightly concave



Now all paint must be removed from the damaged area, by rubbing with coarse abrasive paper. Alternatively, a wire brush or abrasive pad can be used in a power drill. Where the repair area meets good paintwork, the edge of the paintwork should be 'feathered', using a finer grade of abrasive paper



In the case of a hole caused by rusting, all damaged sheet-metal should be cut away before proceeding to this stage. Here, the damaged area is being treated with rust remover and inhibitor before being filled



Mix the body filler according to its manufacturer's instructions. In the case of corrosion damage, it will be necessary to block off any large holes before filling – this can be done with aluminium or plastic mesh, or aluminium tape. Make sure the area is absolutely clean before ...



... applying the filler. Filler should be applied with a flexible applicator, as shown, for best results; the wooden spatula being used for confined areas. Apply thin layers of filler at 20-minute intervals, until the surface of the filler is slightly proud of the surrounding bodywork



Initial shaping can be done with a Surform plane or Dreadnought file. Then, using progressively finer grades of wet-and-dry paper, wrapped around a sanding block, and copious amounts of clean water, rub down the filler until really smooth and flat. Again, feather the edges of adjoining paintwork



The whole repair area can now be sprayed or brush-painted with primer. If spraying, ensure adjoining areas are protected from over-spray. Note that at least one inch of the surrounding sound paintwork should be coated with primer. Primer has a 'thick' consistency, so will find small imperfections



Again, using plenty of water, rub down the primer with a fine grade wet-and-dry paper (400 grade is probably best) until it is really smooth and well blended into the surrounding paintwork. Any remaining imperfections can now be filled by carefully applied knifing stopper paste



When the stopper has hardened, rub down the repair area again before applying the final coat of primer. Before rubbing down this last coat of primer, ensure the repair area is blemish-free – use more stopper if necessary. To ensure that the surface of the primer is really smooth use some finishing compound



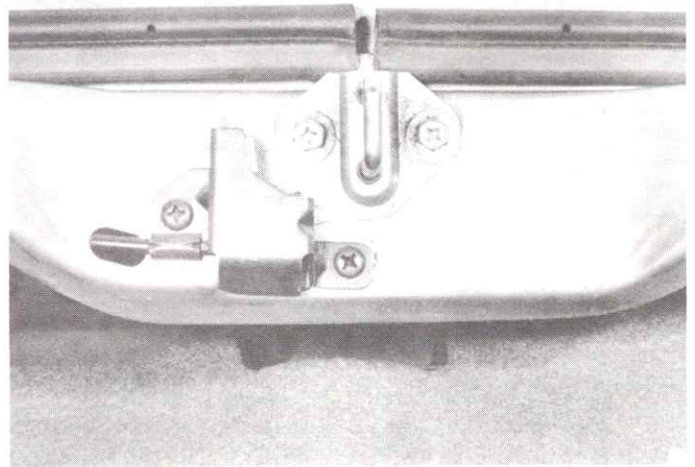
The top coat can now be applied. When working out of doors, pick a dry, warm and wind-free day. Ensure surrounding areas are protected from over-spray. Agitate the aerosol thoroughly, then spray the centre of the repair area, working outwards with a circular motion. Apply the paint as several thin coats



After a period of about two weeks, which the paint needs to harden fully, the surface of the repaired area can be 'cut' with a mild cutting compound prior to wax polishing. When carrying out bodywork repairs, remember that the quality of the finished job is proportional to the time and effort expended



11.2A Tailgate lock ...



11.2B ... and striker

### 11 Tailgate lock – removal, refitting and adjustment

- 1 The tailgate lock is contained in the tailgate, with the striker on the floor pan of the luggage compartment.
- 2 To remove either component, remove the securing bolts. The remote release mechanism is held by two screws (photos).
- 3 Refitting is a reversal of removal.

#### Adjustment

- 4 Ensure that the tailgate is central in its aperture.
- 5 If necessary, adjust the tailgate by loosening the hinge bolts and centralising the tailgate. Then adjust the striker so it is in the centre of the lock.

### 12 Tailgate remote release mechanism – general and adjusting

- 1 The tailgate remote release mechanism cable is operated by a lever by the driver's seat. It is held by two bolts.
- 2 The cable is routed to the tailgate lock under the carpet.
- 3 Adjust the release lever end as shown in Fig. 11.1, so that there is between zero and 1 mm slack between the cable end and the release lever.

### 13 Front door trim – removal and refitting

- 1 Undo the screws and remove the armrest (photo).

- Opener cable: Do not attempt to bend cable using excessive force.

#### Opener handle adjustment

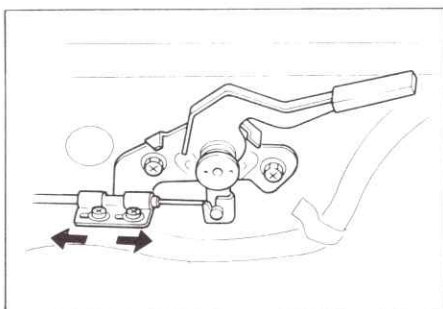


Fig. A

#### Opener adjustment

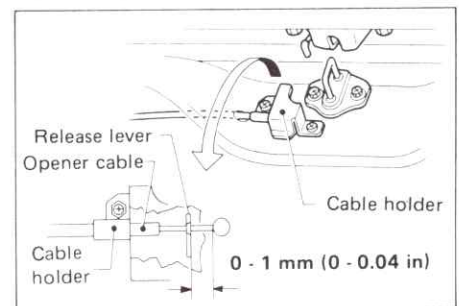


Fig. B

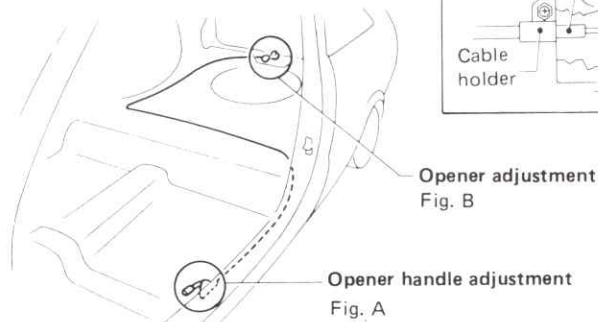


Fig. 11.1 Components of the tailgate remote release mechanism (Sec 12)

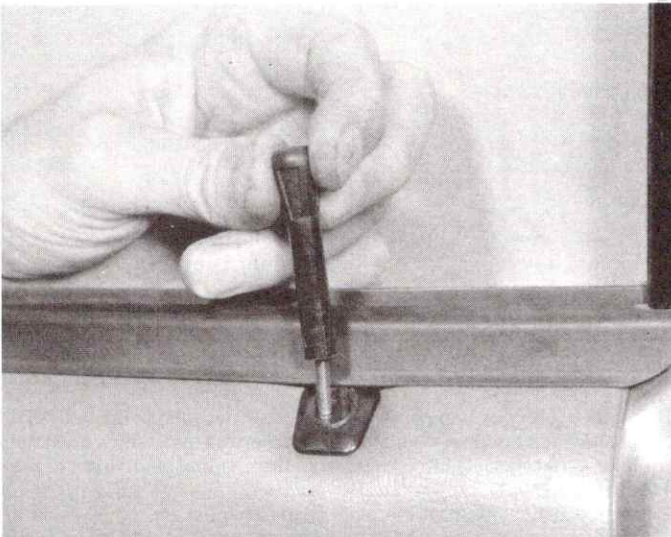
- 2 Prise off the plastic surround from the door release handle.
- 3 Unscrew the door lock plunger knob and remove the guide plate (photos).
- 4 Remove the window regulator handle. Do this by using a hook made from wire to pull the spring clip from the handle, then pull the handle from the driveshaft (photos).
- 5 Remove the embellishing plate from around the rear view mirror and prise up the finishing strip (photo).
- 6 The door trim panel may now be removed by carefully prising it away from the door. It is held at intervals by plastic poppers (photo).
- 7 Refitting is a reversal of removal. Note, however, that it will be necessary to fit the spring clip to the window regulator handle before fitting the handle.
- 8 The plastic sheet which is stuck to the door with mastic should always be refitted as it prevents damp entering the door (photo).

#### 14 Door lock – removal and refitting

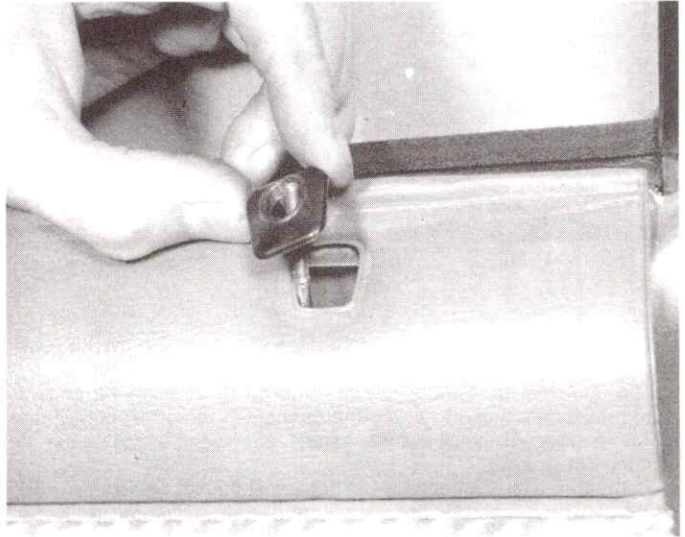
- 1 Remove the trim panel, as described in the preceding Section.
- 2 Unscrew the lock plunger knob and the screws which hold the lock assembly to the door edge (photo).



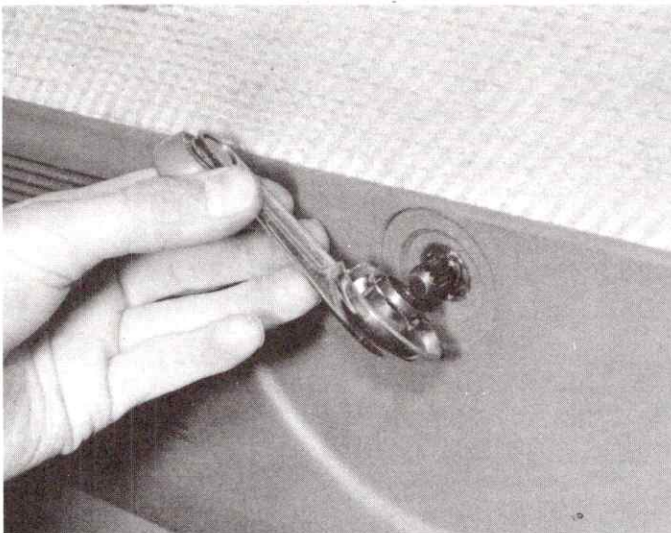
13.1 Remove the armrest screws ...



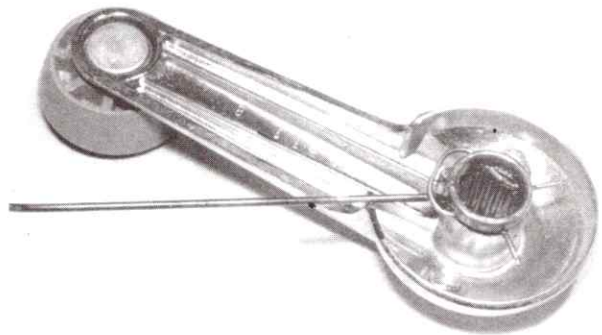
13.3A ... the door lock plunger knob ...



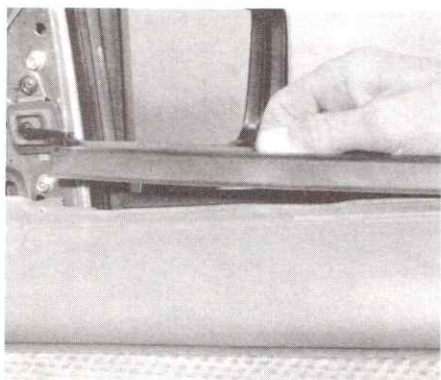
13.3B ... and guide plate



13.4A Removing the door window handle



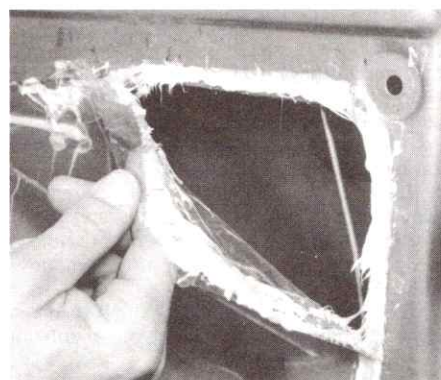
13.4B Using wire to remove the retaining clip (handle removed to show clip and wire)



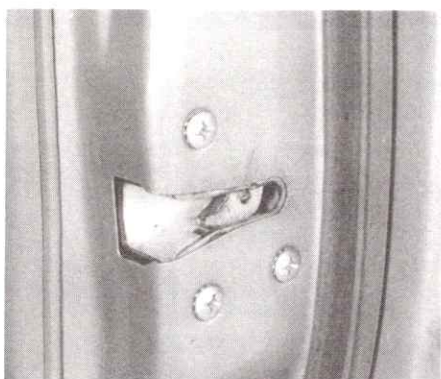
13.5 Lifting off the finishing strip



13.6 Prise off the door trim panel



13.8 Don't forget the plastic sheet



14.2 Door lock retaining screws



14.4 Door lock cylinder viewed from inside

Striker

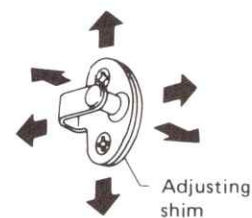


Fig. 11.2 Front door striker adjustment (Sec 14)

3 Disconnect the control rods from the lock and withdraw the lock through the aperture in the door inner panel.

4 The door exterior handle can be removed by unscrewing its two fixing nuts by passing a tool through the hole in the upper part of the door inner panel. The lock cylinder can be removed after prising out its retaining clip (photo).

5 Refitting is a reversal of removal, but adjust the door exterior handle by turning the stepped bush on the control rod as required, and also adjust the door striker as necessary.

6 Shims are available for use behind the striker.

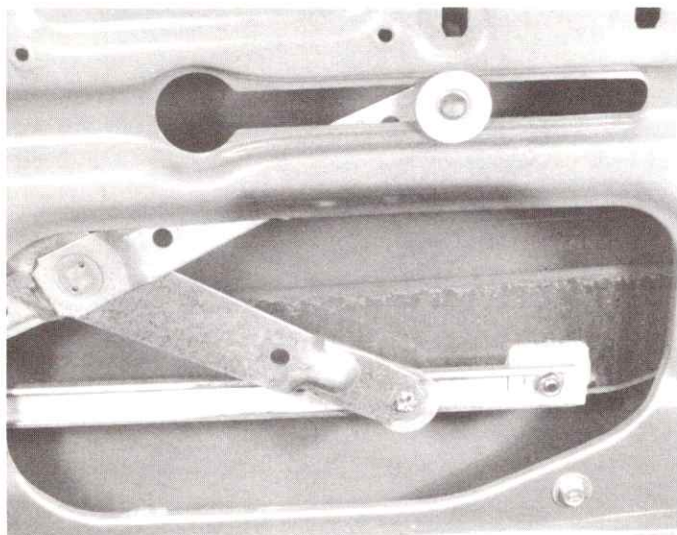
### 15 Front door window – removal and refitting

1 Remove the door trim panel, as previously described (Section 13).

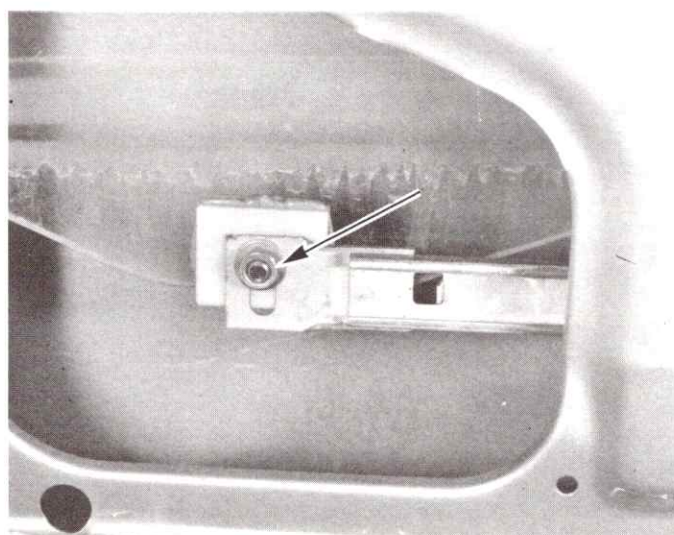
2 Unscrew the window regulator fixing screws. Lower and swivel the regulator and release its lifting arms from the channel at the base of the glass (photos).

3 Release the screw from the glass guide channel.

4 Lower the glass fully and remove the two weatherseal strips from the glass slot. These are held by spring clips.



15.2A Window regulator scissors



15.2B Lower channel fixing nut

- 5 Pull the glass upwards, tilt it and remove it from the door.
- 6 If a new window is being fitted, tap the base channel onto it using a wooden or plastic-faced hammer.
- 7 Refit by reversing the removal operations. Adjust the position of the glass guide channel before tightening its screw so that the window moves up and down smoothly.

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### 16 Rear windows (3-door) – removal and refitting

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- 1 Undo and remove the screws securing the rear latch (photo).
- 2 Remove the screws from the two front hinges (photo) and remove the window.
- 3 Refitting is a reversal of removal.

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### 17 Front door – removal and refitting

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- 1 The door hinges are of bolt-on type (photo).
- 2 Open the door wide and support its lower edge on jacks or blocks with pads of rag to prevent damage to the paintwork.

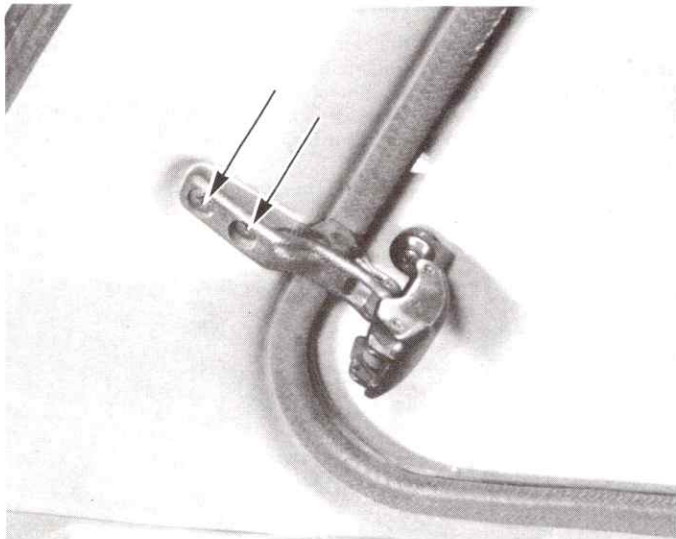
- 3 Disconnect the check strap either by removing the fixing screws or by driving out the roll pin (photo).
- 4 Mark the position of the hinges on the body with a soft pencil and then support the weight of the door and remove the hinge bolts.
- 5 Lift the door from the vehicle.
- 6 Refitting is a reversal of removal. Provided the hinges are positioned within their original marked areas the door should close satisfactorily. Adjustment may be carried out by releasing the hinge bolts and moving the door.
- 7 The striker on the door pillar may also be adjusted to ensure smooth positive closure (photo).
- 8 Later models incorporate a hinge reinforcement plate to help prevent door sag.

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### 18 Windscreen and tailgate window – renewal

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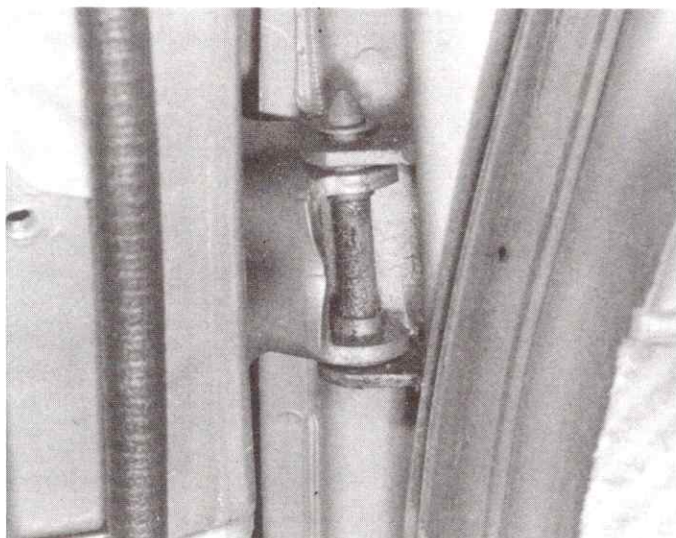
Both the windscreen and the tailgate window are sealed using a primer and sealant, which requires temperature and humidity to be at a certain level for complete curing. It is recommended that this be left to your local dealer, or auto glass replacement specialist.



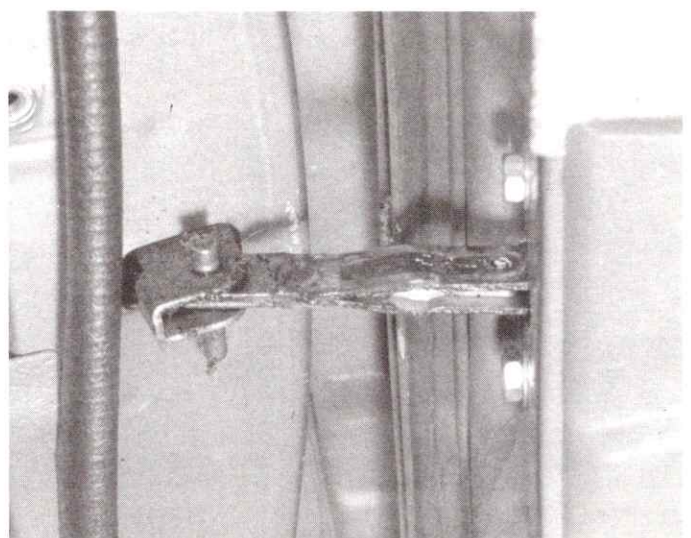
16.1 Rear window latch securing screws



16.2 Rear window hinge screws



17.1 Front door hinge



17.3 Door check strap



17.7 Striker plate

### 19 Interior trim and mouldings – general

- 1 Most of the interior trim and mouldings are of plastic construction and care should be exercised when removing or refitting it.
- 2 Clips are used extensively to fix the trim, with self-tapping screws in certain positions (photos).
- 3 Removal of the headlining is best left to an expert.

### 20 Exterior trim and mouldings – general

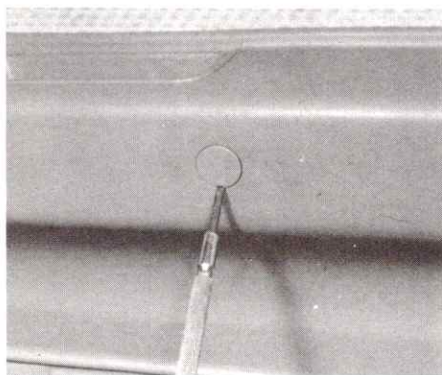
- 1 The exterior body trim is either clipped in position or held by double-sided tape.
- 2 The side and rear guard mouldings are secured by double-sided tape. To remove a moulding, the use of an electrically-operated heat gun will be found to be the most effective.

### 21 Front seat – removal and refitting

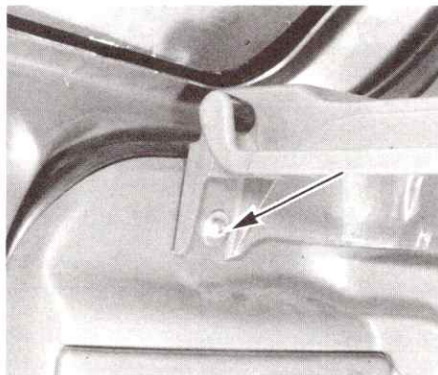
- 1 Slide the seat fully rearwards and undo the bolts securing the runners to the floor pan (photo).
- 2 Slide the seat forward and repeat the operation at the rear of the runners (photo).
- 3 Remove the seat.
- 4 The adjusting mechanism should be greased periodically (photo).
- 5 Refitting is a reversal of removal.

### 22 Rear seat – removal and refitting

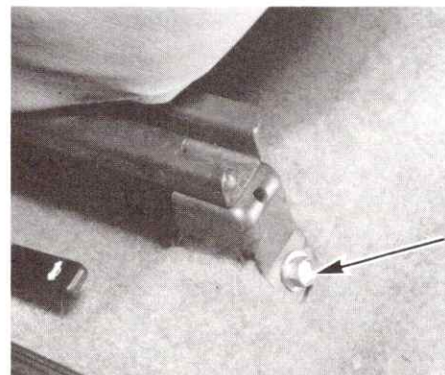
- 1 Grip the front edge of the seat cushion and pull it upwards to release the tongues from the retaining recesses (photo).
- 2 Pull the cushion forwards and remove it from the car.
- 3 Either a single or double backrest is fitted. To remove the backrest release it from the upper clip, fold it forwards, then unbolt the pivot brackets.
- 4 Refitting is a reversal of removal. The upper retaining bracket may be adjusted within the elongated screw holes (photo).



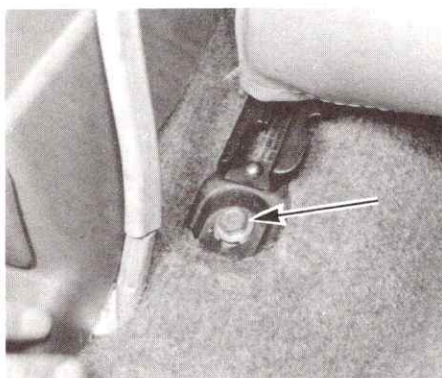
19.2A Typical screw cover being levered out



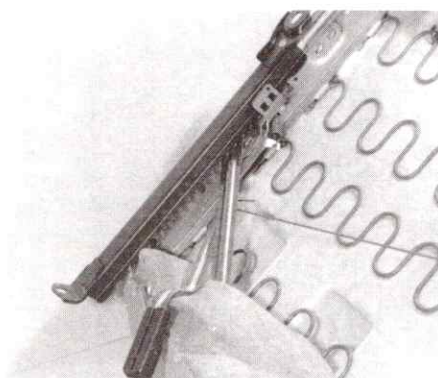
19.2B Self-tapping screws



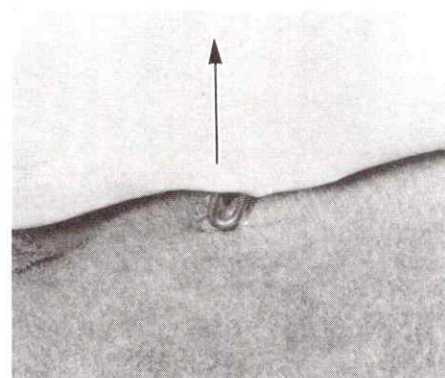
21.1 Front seat runner retaining bolt (front)



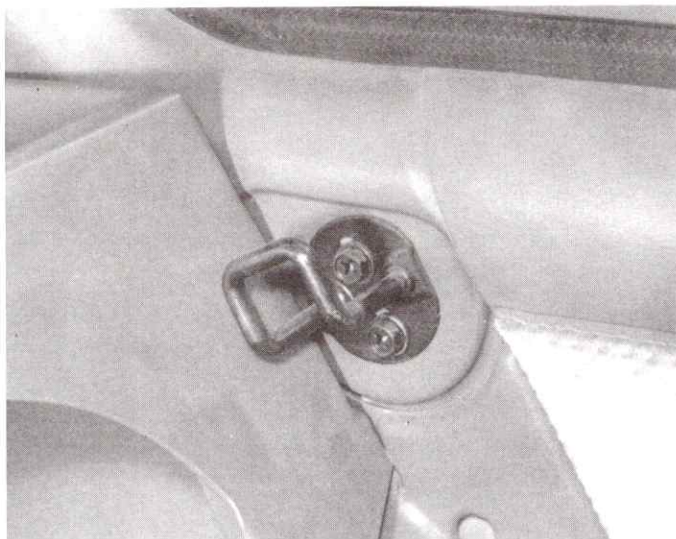
21.2 Front seat runner retaining bolt (rear)



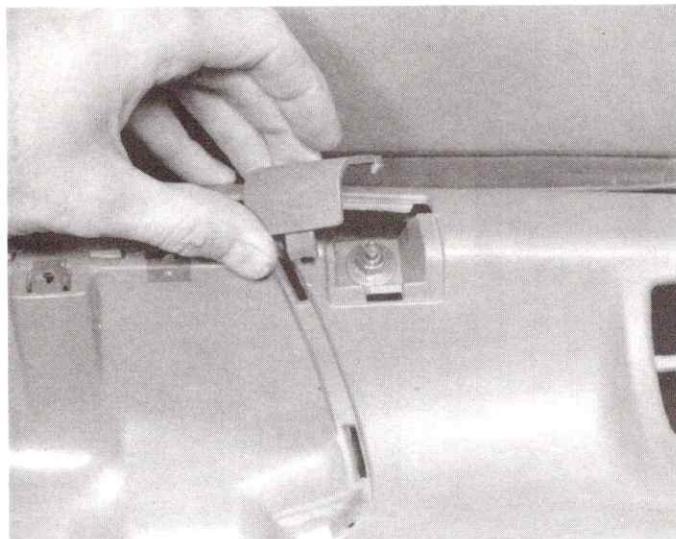
21.4 Seat adjustment mechanism



22.1 Pull the rear seat squab upwards to release it



22.4 Upper retaining bracket for seat back



23.3A Facia panel top nuts are concealed beneath plastic covers

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### 23 Facia panel – removal and refitting

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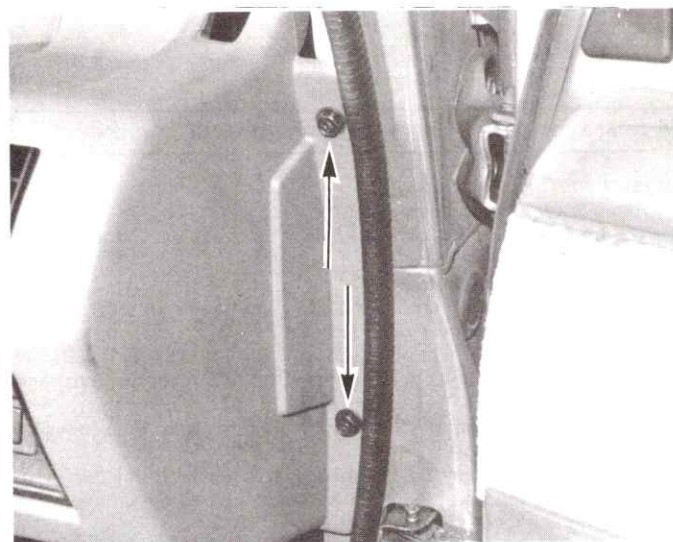
- 1 Remove the instrument panel, speedometer cable, radio and facia mounted switches as described in Chapter 12.
- 2 Remove the choke cable (Chapter 3), steering wheel (Chapter 10) and the heater controls and ducting (Section 31 and 34).
- 3 Remove the plastic covers (photo) which conceal the top mounting nuts and remove them and the side mounting bolts (photo).
- 4 Before withdrawing the facia panel ensure all electrical leads are disconnected.
- 5 Refitting is a reversal of removal.

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### 24 Sunroof – removal and refitting

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- 1 The sunroof consists of a glass roof panel and a sunshade plate attached under the glass.
- 2 To remove the sunshade plate, hold the plate while unscrewing the retaining bolts. Pull the hooks of the plate out of their holders.
- 3 To remove the sunroof (always having first removed the sunshade plate), tilt the roof and push in the two buttons on the handle while pushing the sunroof upwards.
- 4 Raise the roof vertical then slide it to the left to disengage it from the hinges.
- 5 Lift the two air deflectors at the front corners of the aperture if the car is to be used with the sunroof removed. Store the sunroof in the special bag in the rear compartment.
- 6 Refitting is a reversal of removal. The sunroof is correctly engaged with the front hinges when the red marks are no longer visible.



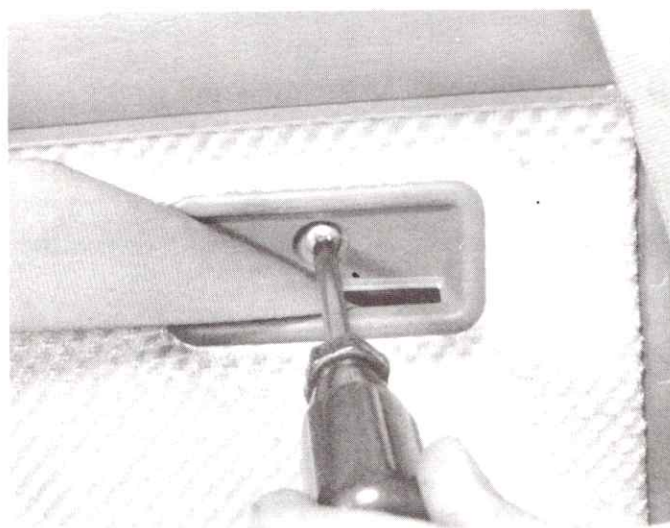
23.3B Side mounting bolts

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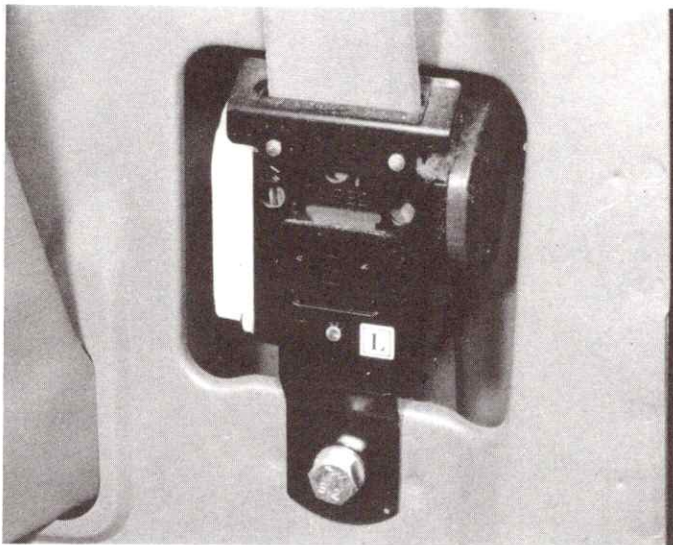
### 25 Seat belts – general

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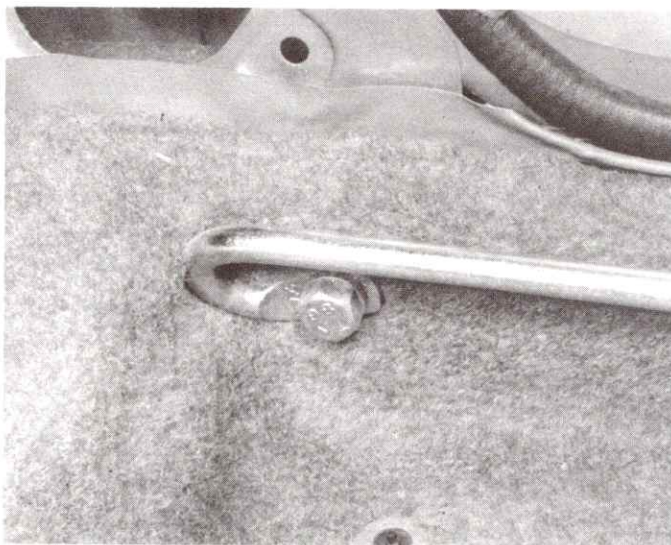
- 1 The condition of the seat belts should be checked regularly for fraying or cuts. If damaged, they should be renewed.
- 2 The retracting mechanism may be reached by removing the trim panel in the passenger compartment (photo).
- 3 The lower anchorage point is bolted to the floor pan (photo), as are the inboard anchorages.
- 4 Do not alter the attachment points, and replace all washers and spacers in their original positions when refitting.



25.2A Removing the trim ...



25.2B ... to reveal the retracting mechanism



25.3 Lower anchorage point

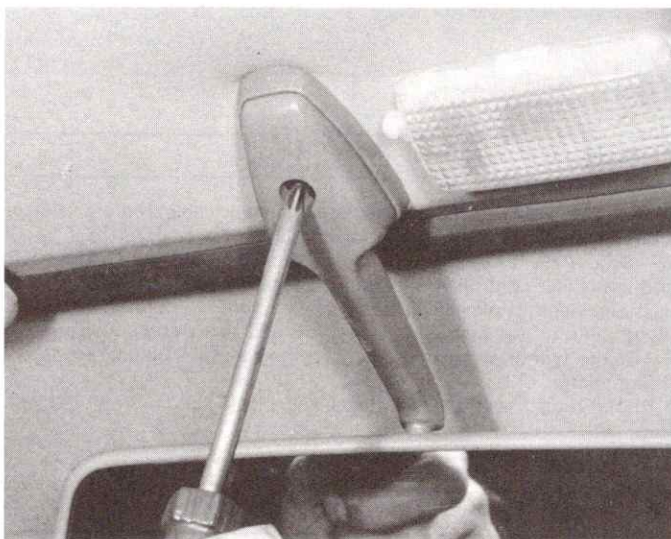
## 26 Rear view mirrors – removal and refitting

### *Interior mirror*

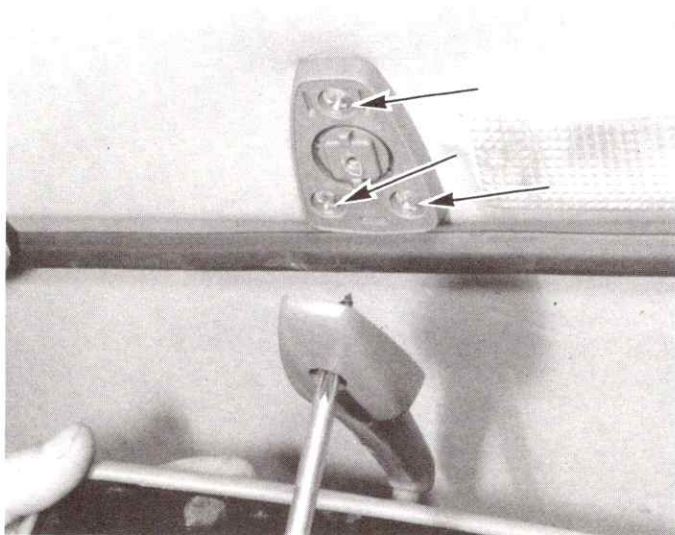
- 1 Remove the securing screw (photo).
- 2 The base is secured to the roof rail by three screws (photo).

### *Door mounted mirror*

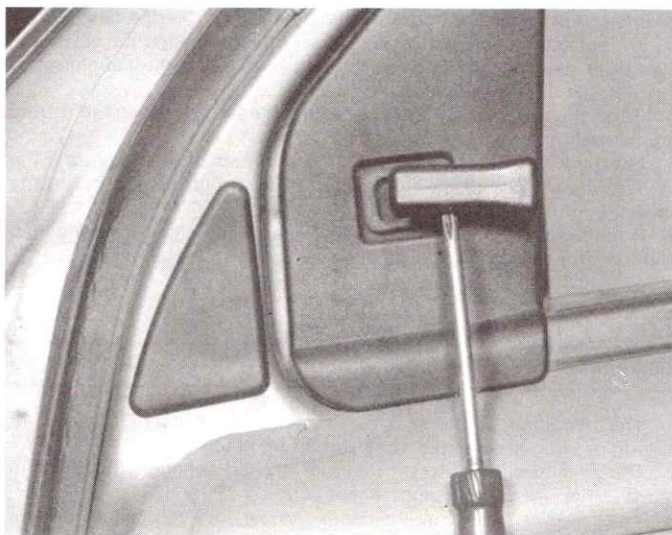
- 3 Undo the screw and remove the adjusting handle (photo).
- 4 Prise off the large cover plate (photo).
- 5 Prise off the front cover plate (photo).
- 6 Remove the three bolts holding the mirror to the door (photo) and remove the mirror.
- 7 The adjusting action may be tightened by doing up the screws on the captive ball (photo).
- 8 The mirror glass may be changed if it is cracked, but this is an extremely fiddly job and it is better to replace the whole unit.
- 9 Refitting is a reversal of removal.



26.1 Remove the screw



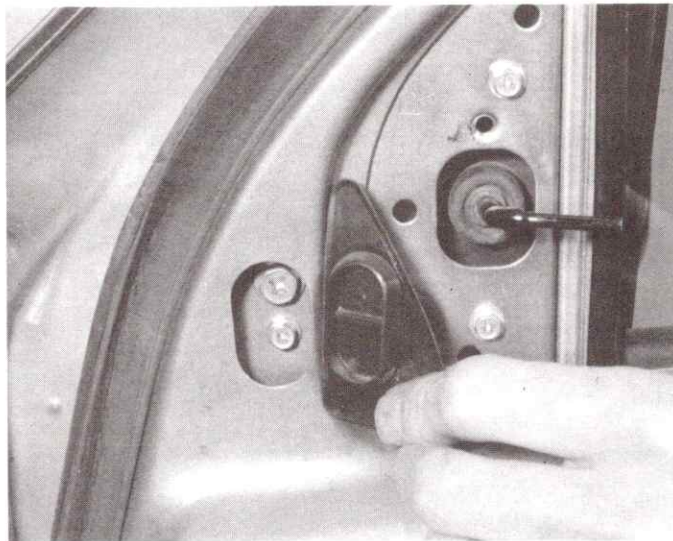
26.2 There are three screws in the base



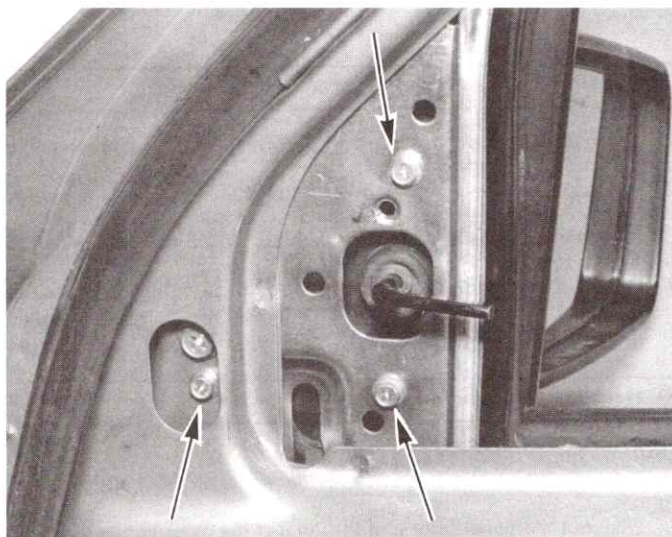
26.3 Remove the screw from the handle



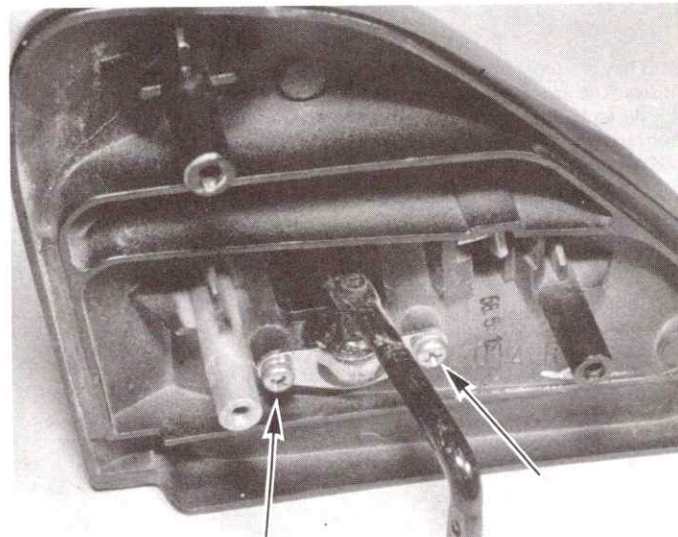
26.4 Prise off the cover plate ...



26.5 ... and front cover



26.6 Remove the three bolts (arrowed)



26.7 Tighten the two screws

### 27 Centre console – removal and refitting

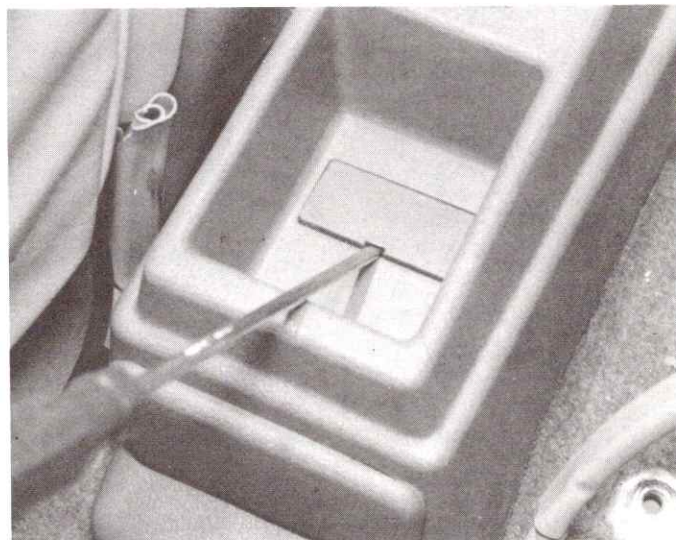
- 1 Prise off the plastic cover (photo) and remove the screws.
- 2 There is another cover and screw at the front end.
- 3 Lift the console from around the handbrake cover (photo).
- 4 Refit in the reverse order.

### 28 Ashtray – removal and refitting

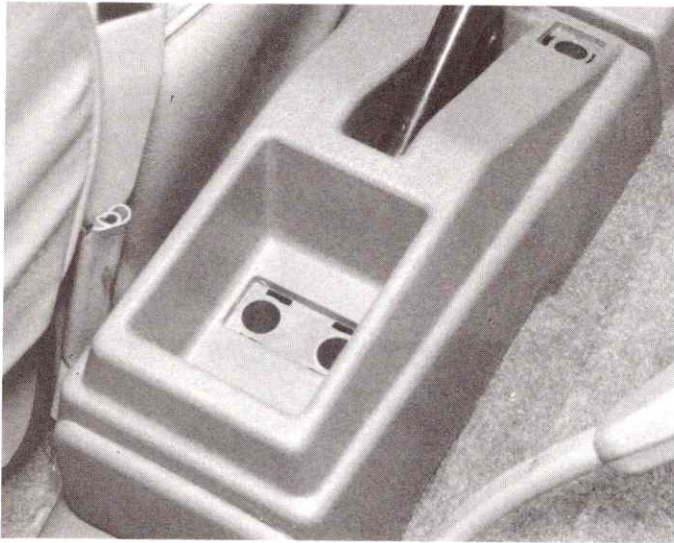
- 1 Snap out the centre part of the ashtray.
- 2 Undo the securing screw (photo) and prise the surround from the trim panel.
- 3 Refit in the reverse order.

### 29 Door weather strips and finishers – general

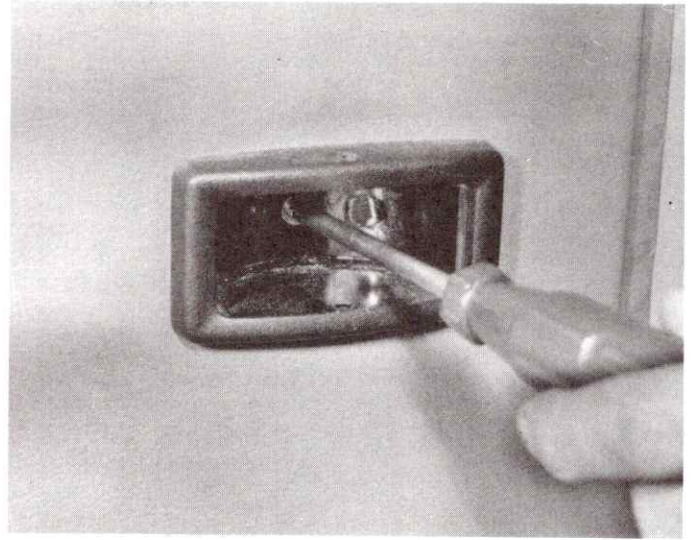
- 1 Should the weather strips or edge finishers become perished they can be renewed.
- 2 New weather strips may be purchased in lengths from your dealer.



27.1 Remove the plastic covers and screws ...



27.3 ... and lift the console



28.2 Removing the retaining screw

- 3 They are fixed in place either by plastic caps, adhesive or are a push fit over the seam edges which they cover.
- 4 When refitting the weather strip, it is usual to start at the centre bottom of the door, and work around, pushing or clipping the strip in place until the ends meet.
- 5 Re-check the strip is pushed fully home all round the edges before cutting to a snug fit.

### 30 Heating and ventilation system – description

- 1 The heater incorporates a matrix to which hot coolant from the engine cooling system is fed.
- 2 A booster, or blower motor, is used to force air through the matrix, where it is heated, before being ducted to the car interior.
- 3 By altering the distribution flaps, hot or cold air may be directed to the feet or to the windscreen, or both.
- 4 Fresh air ventilation is supplied through facia mounted grilles, air being drawn in through the grille at the base of the windscreen. Stale air is exhausted through grilles on the rear pillars.

### 31 Heater – removal and refitting

#### Control panel and lever assembly

- 1 Pull off the plastic knobs from the ends of the control levers (photos).
- 2 Prise out the panel front and disconnect the cigar lighter (photo), remove the panel.
- 3 Remove the cable clips and unhook the cables at the distribution flap ends (photo). **Note:** There are three such cables.
- 4 Disconnect the electrical lead to the blower motor.

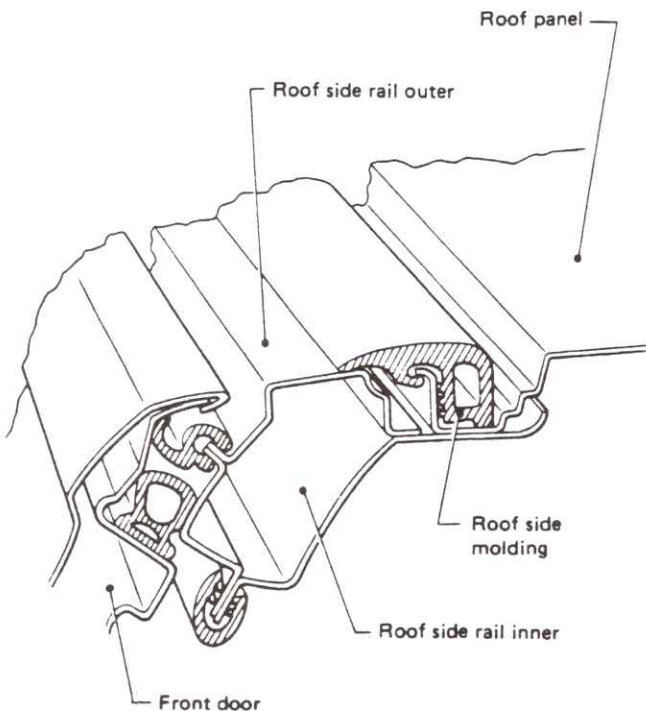


Fig. 11.3 Door weather strips and side moulding (Sec 29)

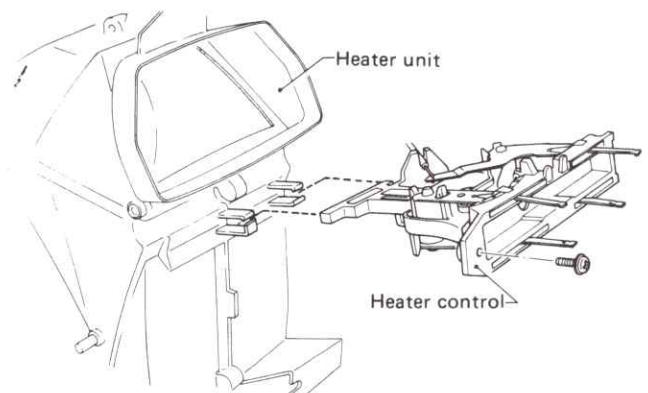
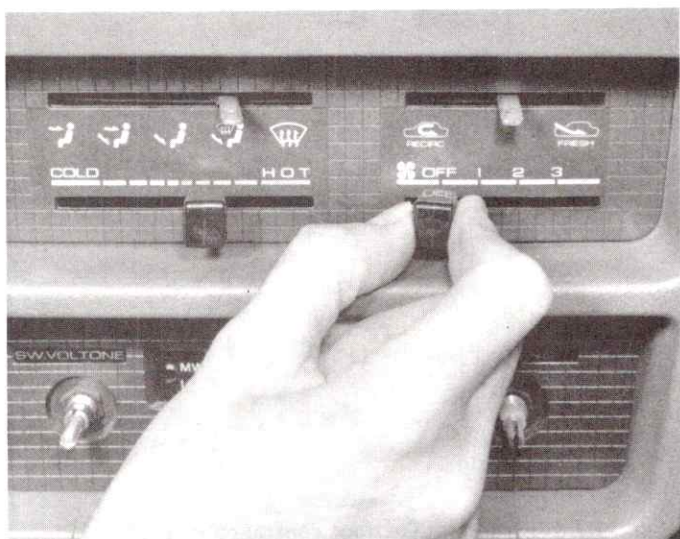


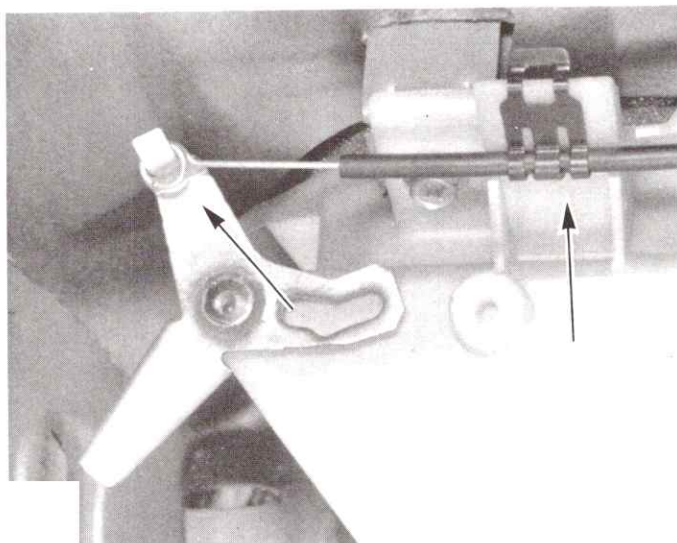
Fig. 11.4 Removing the heater control lever assembly (Sec 29)



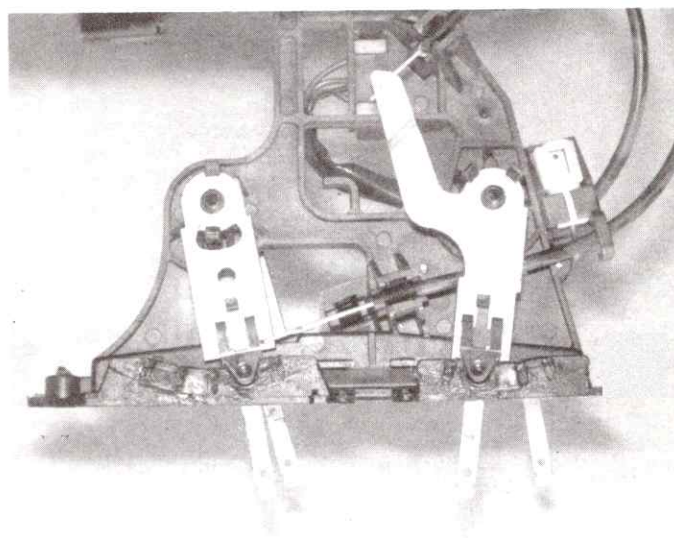
31.1 Remove the control lever knobs



31.2 Prise out the panel and disconnect the cigar lighter



31.3 Remove the cable clips and unhook the cable ends (arrowed)



31.5 Control lever assembly

- 5 Remove the screw securing the control lever assembly and then slide it to the right to disengage the rear clips. Pull the unit forward sufficiently to unhook the control cables, and remove it (photo).
- 6 Refitting is a reversal of removing, but see Section 32 for control cable adjustment.

### 32 Heater control cables – adjustment

- 1 The control cables are adjusted by altering their positions in the cable fixing clips, at the control flap ends.
- 2 When fitting new cables, fit the control lever ends first, setting the outer sheath in the cable fixing clip so that each lever has full and free movement.
- 3 Refer to Figs. 11.5 to 11.10 and set the control flap ends of the cables.
- 4 Later models may have a water cock added to the system.
- 5 When adjusting the water cock control rod (refer to Fig. 11.11) disconnect the temperature control cable from the air mix door lever before the adjustment.

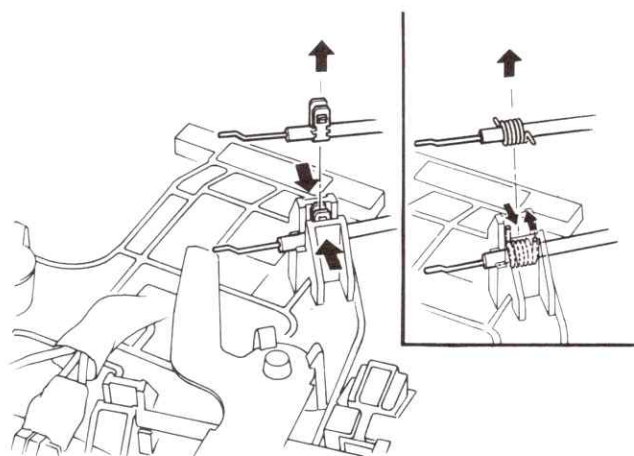


Fig. 11.5 Control cable clips at control lever end (Sec 32)

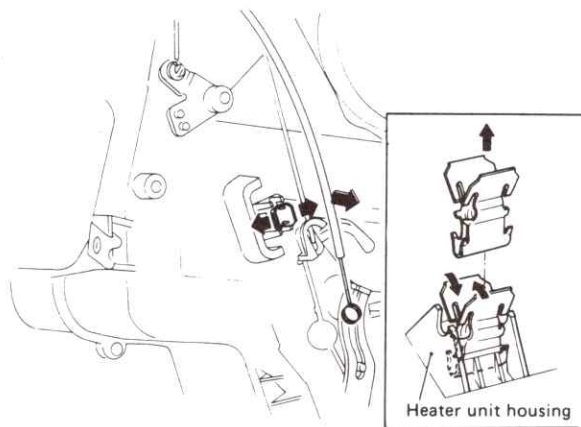


Fig. 11.6 Control cable clips at central flap end (Sec 32)

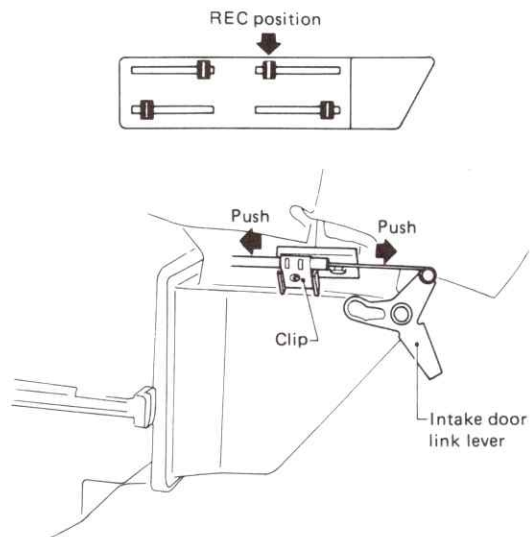


Fig. 11.7 Adjusting intake door central cable (Sec 32)

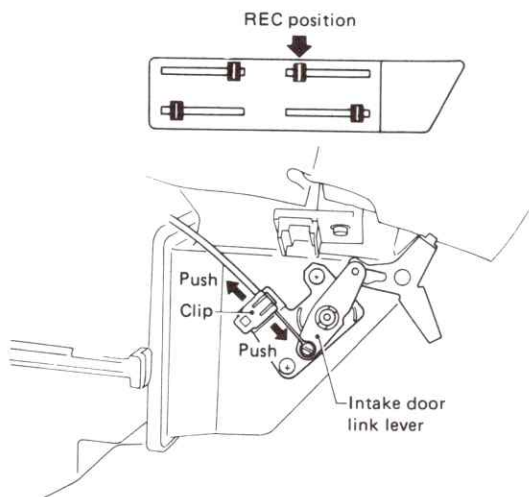


Fig. 11.8 Adjusting intake door control cable (air conditioner models) (Sec 32)

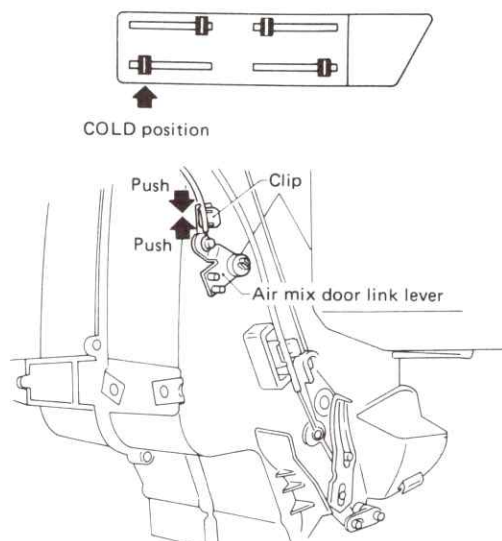


Fig. 11.9 Adjusting the temperature control cable (Sec 32)

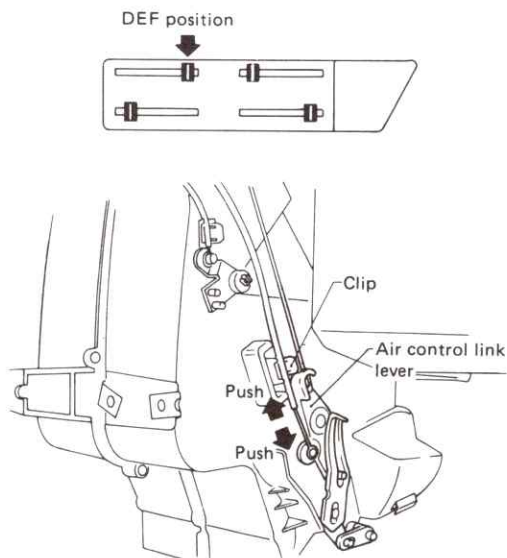


Fig. 11.10 Adjusting the air control cable (Sec 32)

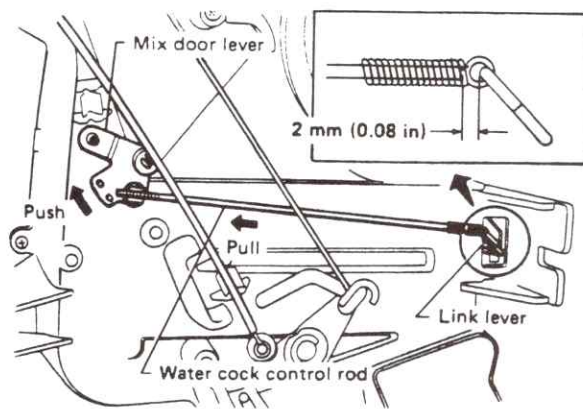


Fig. 11.11 Water cock control rod adjustment (Sec 32)

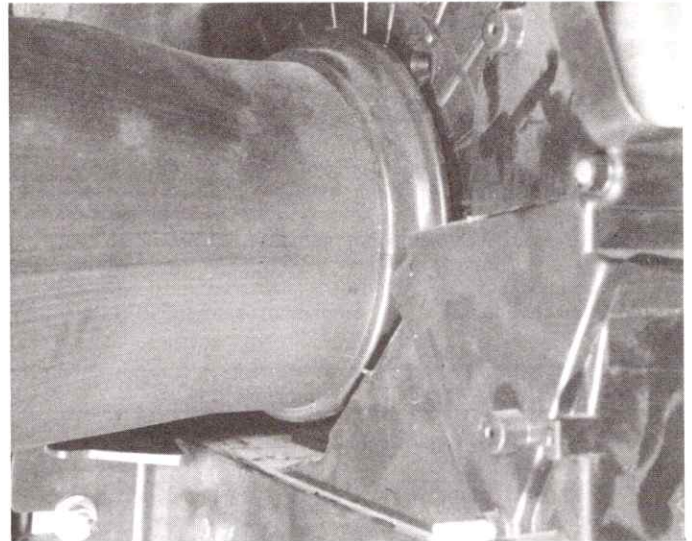
- 6 To adjust the rod, push the door lever and pull the rod in the direction of the arrows, before measuring the gap.
- 7 Reconnect the temperature control cable on completion.

### 33 Blower motor – removal and refitting

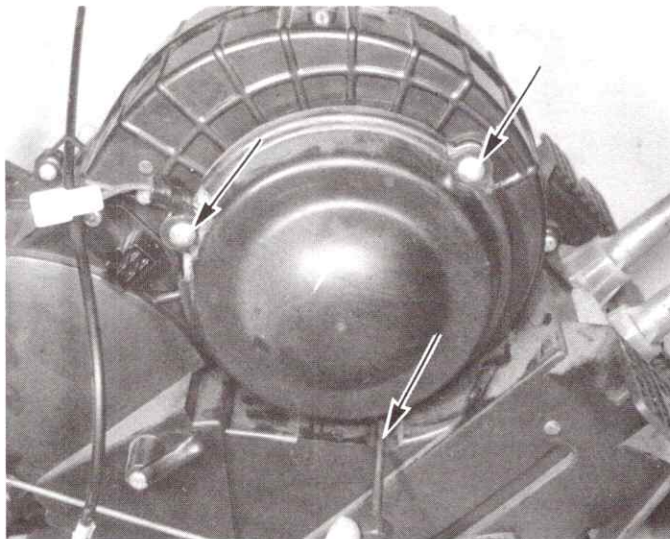
- 1 Remove the heater duct. This is a flexible duct and simply pulls off (photo).
- 2 Remove the three screws securing the blower motor in the housing (photo).
- 3 Disconnect the electrical lead and remove the blower motor and impeller (photo).
- 4 The compressor can be separated from the motor by removing the central nut (photo).
- 5 Refitting is a reversal of removal.

### 34 Heater (complete unit) – removal and refitting

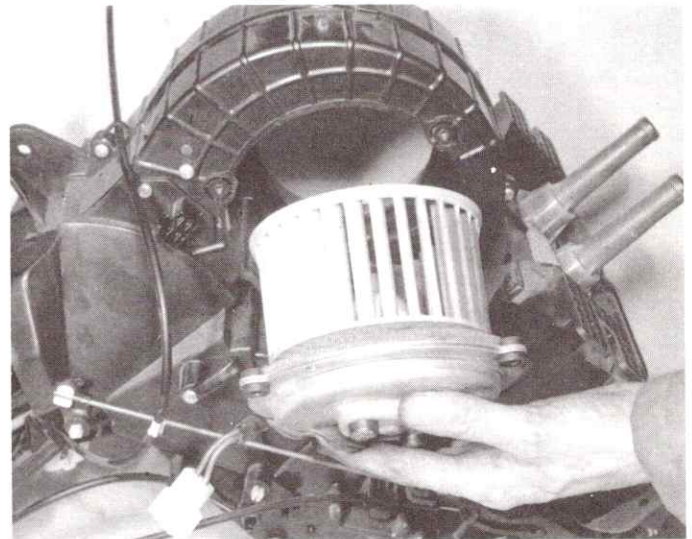
- 1 Drain the cooling system, as described in Chapter 2.
- 2 Disconnect the heater hoses in the engine compartment (photo).



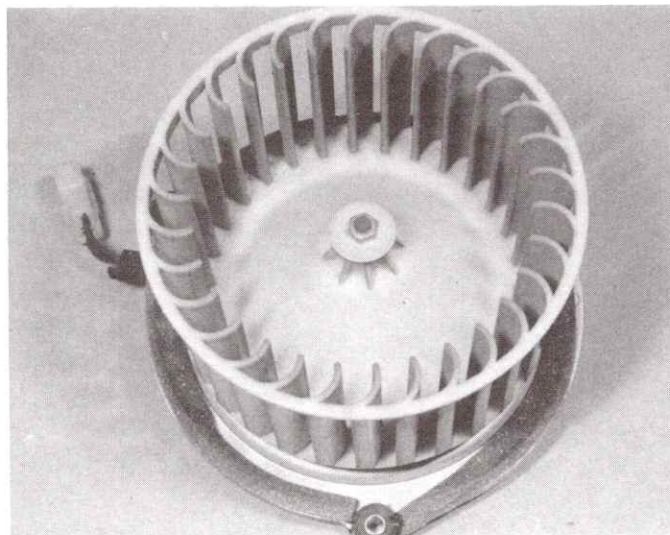
33.1 Remove the heater duct



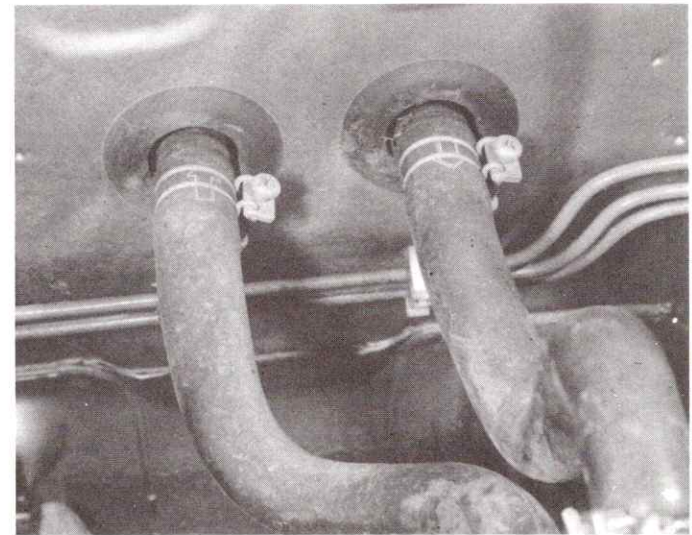
33.2 Undoing the three securing screws



33.3 Removing the blower motor



33.4 Remove the central nut to separate the impeller from the motor

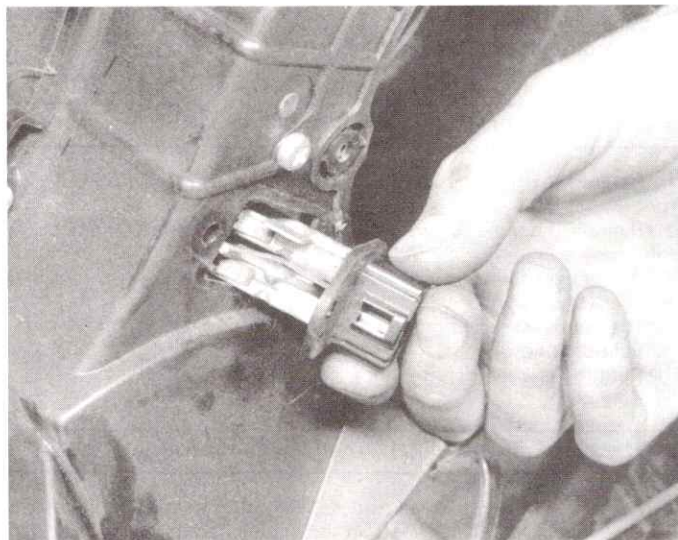


34.2 The heater hoses in the engine compartment

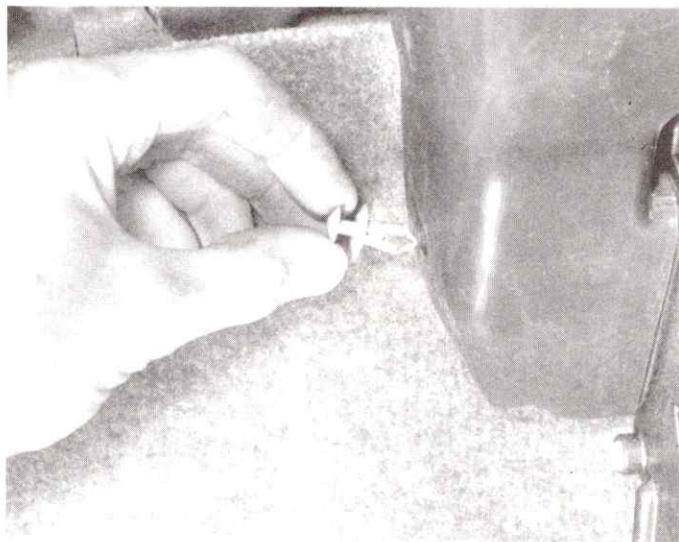
- 3 Remove the fascia panel as described in Section 23.
- 4 Remove the heater control panel as described in Section 31.
- 5 Disconnect the electrical lead to the resistor (photo).
- 6 Remove the fixing screws from the ducting (photo) and remove the ducting.
- 7 Remove the nuts and bolts securing the heater unit to the body (photos).
- 8 Manoeuvre the heater unit from the vehicle.
- 9 The casing may be split by removing the securing screws, revealing the individual components (photo).
- 10 The ducting may be removed from the fascia panel by removing the retaining screws (photo).
- 11 Refitting is a reversal of removal.
- 12 Refill the cooling system on completion, as described in Chapter 2.

### 35 Air conditioner – operation and precautions

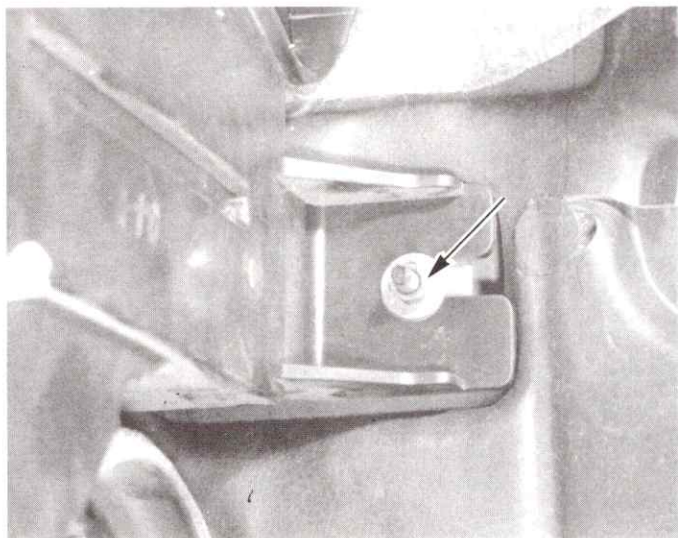
- 1 An air conditioner with combined heater is an option on certain models.
- 2 The refrigerant fluid used in the system is odourless and non-poisonous.



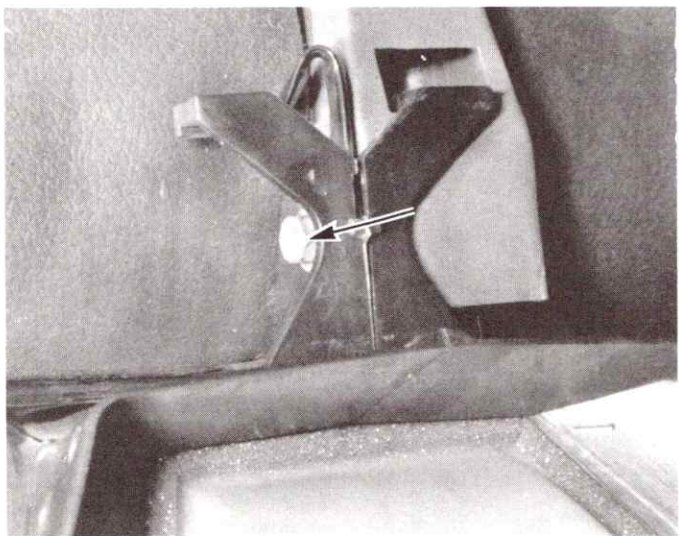
34.5 Removing the resistor



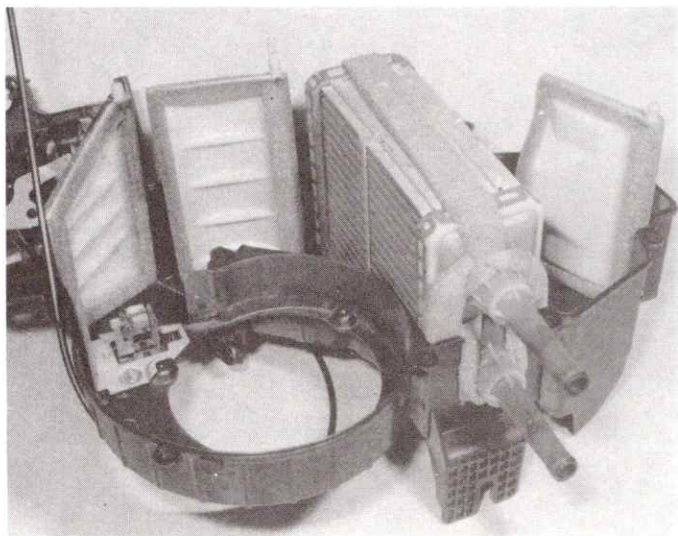
34.6 Typical duct retaining screw



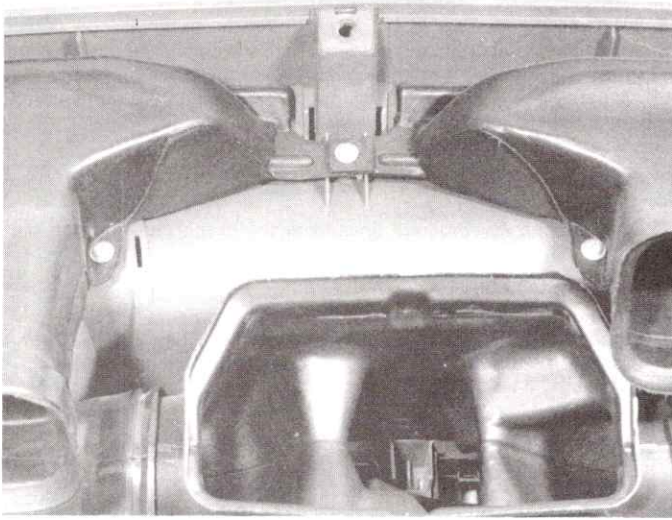
34.7A Heater unit retaining nut ...



34.7B ... and bolt, at the top



34.9 Heater unit removed and partly disassembled



34.10 Ducting behind the fascia panel

- 3 Leaks are not dangerous unless the fluid or vapour comes into contact with a naked flame when poisonous gas is created.
- 4 Refrigerant fluid is dangerous to the eyes and skin and contact should be avoided.
- 5 If overhaul operations require the removal of any part of the system, try and move the obstructing component within the limits of its flexible discharged connecting hoses. If this is not sufficient then have

the system discharged by your dealer or a competent refrigeration engineer. He should also be employed to recharge the system on completion. It is most important that the refrigerant lines and components are kept free from internal moisture and your dealer will use a vacuum pump to ensure this after the circuit has been broken.

6 To operate the air conditioner, push the A/C switch to ON and the fan control lever to a setting between 1 and 3. The air conditioner warning lamp will come on.

7 Two further settings are available -- RECIRC and FRESH. The RECIRC setting should be selected for rapid cooling in very hot or humid conditions.

8 To obtain the best results from your air conditioner, observe the following points.

9 If the vehicle has been parked in the sun for a long time with the windows closed, open them fully and drive along for two or three minutes after switching on the air conditioner.

10 Under normal conditions, keep all windows and ventilators closed when the air conditioner is working.

11 During the summer, if the air conditioner has not been used for a week, turn the fan control lever on and off several times at three second intervals with the engine idling.

12 During the winter, run the system for ten minutes at monthly intervals.

13 If the vehicle is being steam cleaned, avoid using the steam on the system components, particularly the condenser.

14 Periodically brush or hose flies and dirt from the condenser which might otherwise restrict its airflow.

### 36 Air conditioner components – removal and refitting

- 1 As already explained in the preceding Section, have the system discharged by your dealer before carrying out any of the following operations.

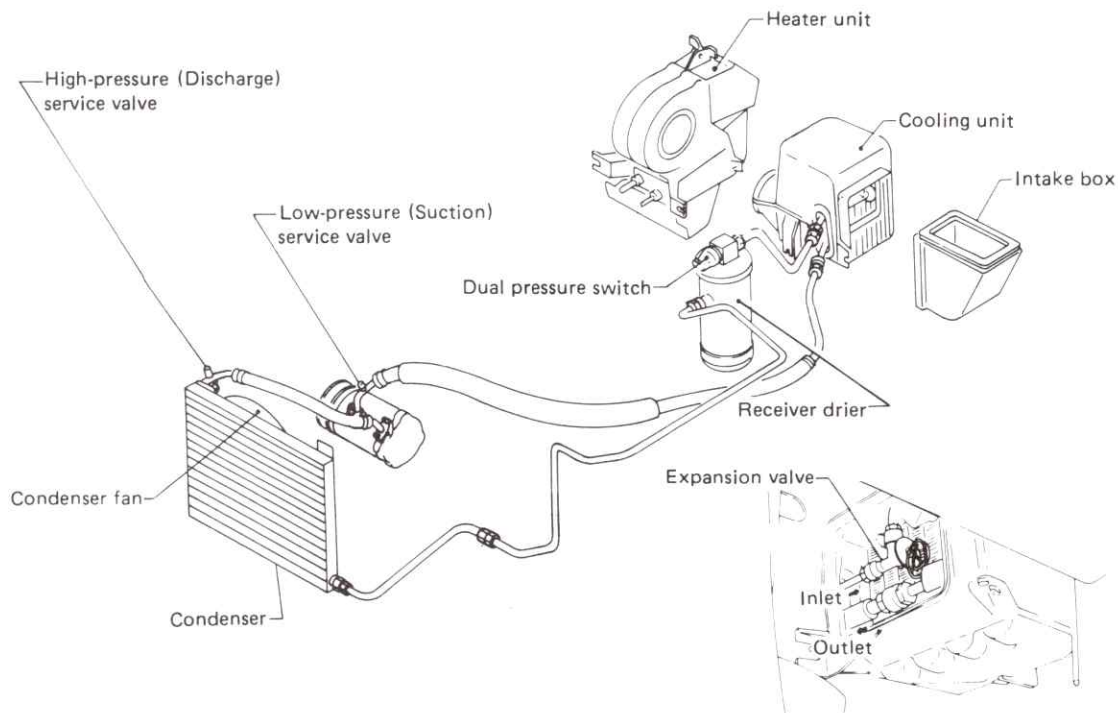


Fig. 11.12 Components of the air conditioning system (Sec 35)

*Condenser*

- 2 Disconnect the battery.
- 3 Remove the radiator grille (Section 7).
- 4 Disconnect the refrigerant pipelines from the condenser and cap them.
- 5 Remove the condenser cooling fan.
- 6 Disconnect the radiator mountings and support the radiator, not allowing it to hang on its hoses.
- 7 Disconnect the condenser mountings.
- 8 Push the radiator towards the engine and lift out the condenser.

*Compressor*

- 9 Disconnect the battery.
- 10 Raise the front of the vehicle and support it on axle stands.
- 11 Remove the compressor drivebelt (refer to Chapter 2).
- 12 Disconnect the compressor clutch harness.
- 13 Disconnect the flexible hoses from the compressor and cap them.

14 Remove the compressor after disconnecting its mounting and adjuster bolts.

15 Keep the compressor in its 'in car' attitude, otherwise oil could enter the low pressure chambers. Should this happen, the compressor pulley must be turned through several revolutions when refitted to the vehicle in order to expel the oil. Failure to do this could result in internal damage once the air conditioning system is operated.

*Evaporator*

- 16 Disconnect the battery.
- 17 Disconnect the refrigerant lines from the evaporator and cap the pipes.

**UK models**

- 18 Remove the instrument panel as described in Chapter 12.
- 19 Remove the mounting screws and withdraw the evaporator.

# Chapter 12 Electrical system

*For modifications, and information applicable to later models, see Supplement at end of manual*

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## Specifications

<b>System type</b> .....	12 volt negative earth
<b>Battery</b>	
Type .....	Maintenance-free
Capacity .....	30 amp hr
<b>Alternator</b>	
Rating .....	35, 40 or 50 amp
Output voltage .....	14.1 to 14.7 volt
Minimum brush wear limit .....	7.0 mm (0.28 in)
<b>Starter motor</b>	
Type .....	Pre-engaged
Minimum brush wear limit .....	11.5 mm (0.453 in)
Clearance between pinion front edge and pinion stopper – manual transmission .....	0.5 to 2.0 mm (0.020 to 0.079 in)
Difference in height of pinion assembly – automatic transmission .....	0.5 to 2.0 mm (0.020 to 0.079 in)

Bulbs	Wattage
Headlamp (sealed beam) .....	65/55
Headlamp (halogen, semi-sealed) .....	60/55
Front combination light:	
Turn signal .....	21
Side light .....	5
Front side turn signal light .....	5
Rear combination light:	
Turn signal .....	21
Stop/tail light .....	21/5
Reversing light .....	21
Rear foglight .....	21
Number plate light .....	5
Interior light .....	5
Luggage compartment light .....	10

Fuses (typical)*	Amps
Headlamps .....	15
Stop/tail lamp .....	15
Horn/hazard warning lights .....	15
Air conditioner .....	15
Rear screen demister .....	15
Heater .....	10
Wash/wipe .....	20
Radiator fan motor .....	15
Engine control .....	15

\*Before replacing any fuse, be sure to check the fuse specifications listed on the fuse box cover. Never use a fuse of higher amperage rating than that specified.

### Torque wrench settings

	lbf ft	kgf m
Alternator bracket bolt .....	7.0 to 9.0	1.0 to 1.2
Alternator adjustment bolt .....	12.0 to 15.0	1.6 to 2.0
Alternator pulley nut .....	36.0 to 47.0	5.0 to 6.5
Alternator tie-bolts .....	2.9 to 4.0	0.40 to 0.55
Starter motor tie-bolts .....	3.6 to 5.1	0.50 to 0.70
Solenoid attachment bolts .....	2.9 to 5.8	0.40 to 0.80

## 1 General description

The major components of the 12 volt negative earth system consist of a 12 volt battery, an alternator (driven from the crankshaft pulley), and a starter motor.

The battery supplies a steady amount of current for the ignition, lighting and other electrical circuits and provides a reserve of power when the current consumed by the electrical equipment exceeds that being produced by the alternator.

The alternator has its own regulator which ensures a high output if the battery is in a low state of charge and the demand from the electrical equipment is high, and a low output if the battery is fully charged and there is little demand from the electrical equipment.

When fitting electrical accessories to cars with a negative earth system it is important, if they contain silicon diodes or transistors, that they are connected correctly, otherwise serious damage may result to the components concerned. Items such as radios, tape players, electronic ignition systems, electronic tachometer, automatic dipping etc, should all be checked for correct polarity.

## 2 Battery – charging

- 1 The battery is of the maintenance-free type and requires no periodic maintenance, apart from cleaning, and occasionally applying petroleum jelly to the terminals to minimise corrosion.
- 2 The recommended method of charging the battery is by running the engine.
- 3 If the engine cannot be started, then charge the battery for at least 4 hours using a 6 amp DC charger, and then try to start the engine.
- 4 If the battery still will not start the engine, it needs renewing.
- 5 The specific gravity of the electrolyte may be taken by removing the blind plug on the top of the battery. *On no account use the blind plug to fill the battery with distilled water.*

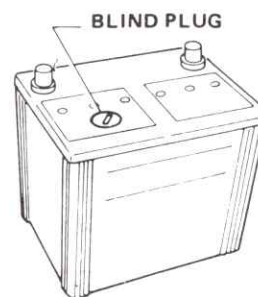
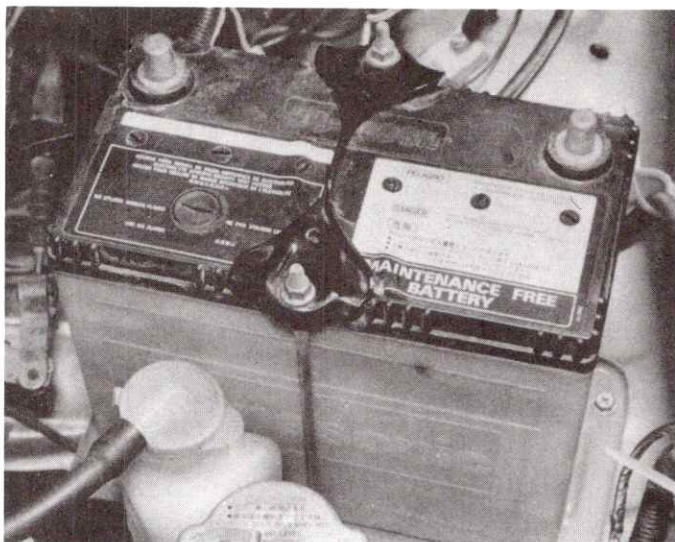


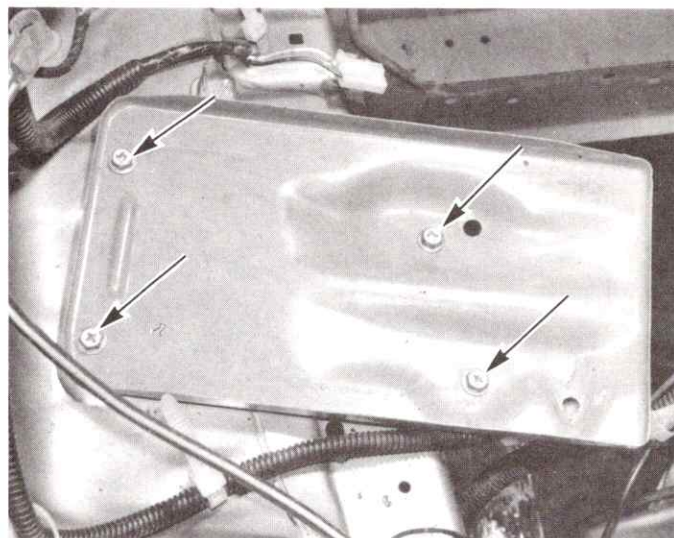
Fig. 12.1 Maintenance-free battery blind plug (Sec 2)

## 3 Battery – removal and refitting

- 1 Open the bonnet, then disconnect the negative and then the positive leads.
- 2 Unscrew the nuts which hold the battery retaining strap in place (photo).
- 3 Remove the retaining strap and lift out the battery, being careful not to tilt it.
- 4 Refitting is a reversal of removing, but make sure the battery is correctly positioned for connecting up positive (+) and negative (-) leads. Reconnect the negative lead **last**.
- 5 The battery tray is held in place by four bolts (photo).



3.2 Battery retaining strap



3.5 Battery tray retaining bolts

#### 4 Alternator – description, maintenance and precautions

- 1 The alternator is mounted on the crankcase at the timing belt end of the engine.
- 2 The unit is driven by a belt from the crankshaft pulley. A voltage regulator is integral with the brush holder plate.
- 3 Keep the drivebelt correctly tensioned (see Chapter 2) and the electrical connections tight.
- 4 Keep the outside of the alternator free from grease and dirt.
- 5 It is important that the battery leads are always disconnected if using electrical welding equipment, the alternator must be disconnected otherwise serious damage can be caused.
- 6 Do not stop the engine by pulling a lead from the battery.

#### 5 Alternator – removal and refitting

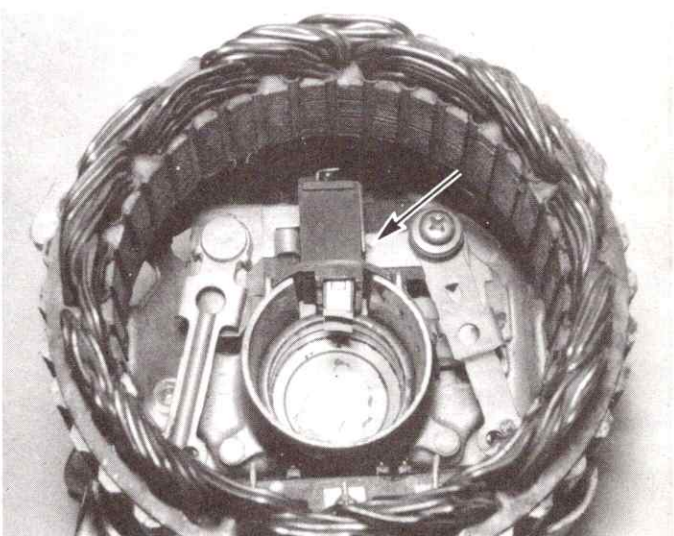
- 1 Disconnect the battery.
- 2 Disconnect the leads from the back of the alternator (photo).
- 3 Loosen the alternator mounting and adjuster bracket bolts, and push the alternator in so that the drivebelt may be slipped off the pulley.
- 4 Remove the adjuster bracket and mounting bolt and remove the alternator from the engine.
- 5 Refitting is a reversal of this procedure, but ensure that any spacers and/or washers go back in their original positions.

#### 6 Alternator – overhaul

- 1 In the event of the charge (ignition) warning lamp not going out after the engine has started or if the battery is being overcharged, or undercharged, the following operations may be carried out to rectify worn brushes of a faulty voltage regulator. If more extensive overhaul is required, or if the alternator has had a long service life, it is recommended that a new or factory-rebuilt unit is obtained.
- 2 Remove the alternator and clean away the external dirt.
- 3 Mark the relative position of the rear cover to the front (drive end) cover by scribing a line on them. Unscrew the tie-bolts.
- 4 Pull off the rear cover with the stator.
- 5 Unscrew the fixing nuts and separate the rear cover from the stator.
- 6 If the brush length is less than the specified minimum the brushes must be renewed. To do this, the brush leads must be unsoldered. The new brushes must be attached quickly to prevent the heat leaking away and damaging adjacent components (photo).



5.2 Wiring connections on the rear of the alternator



6.6 View inside alternator showing brush holder

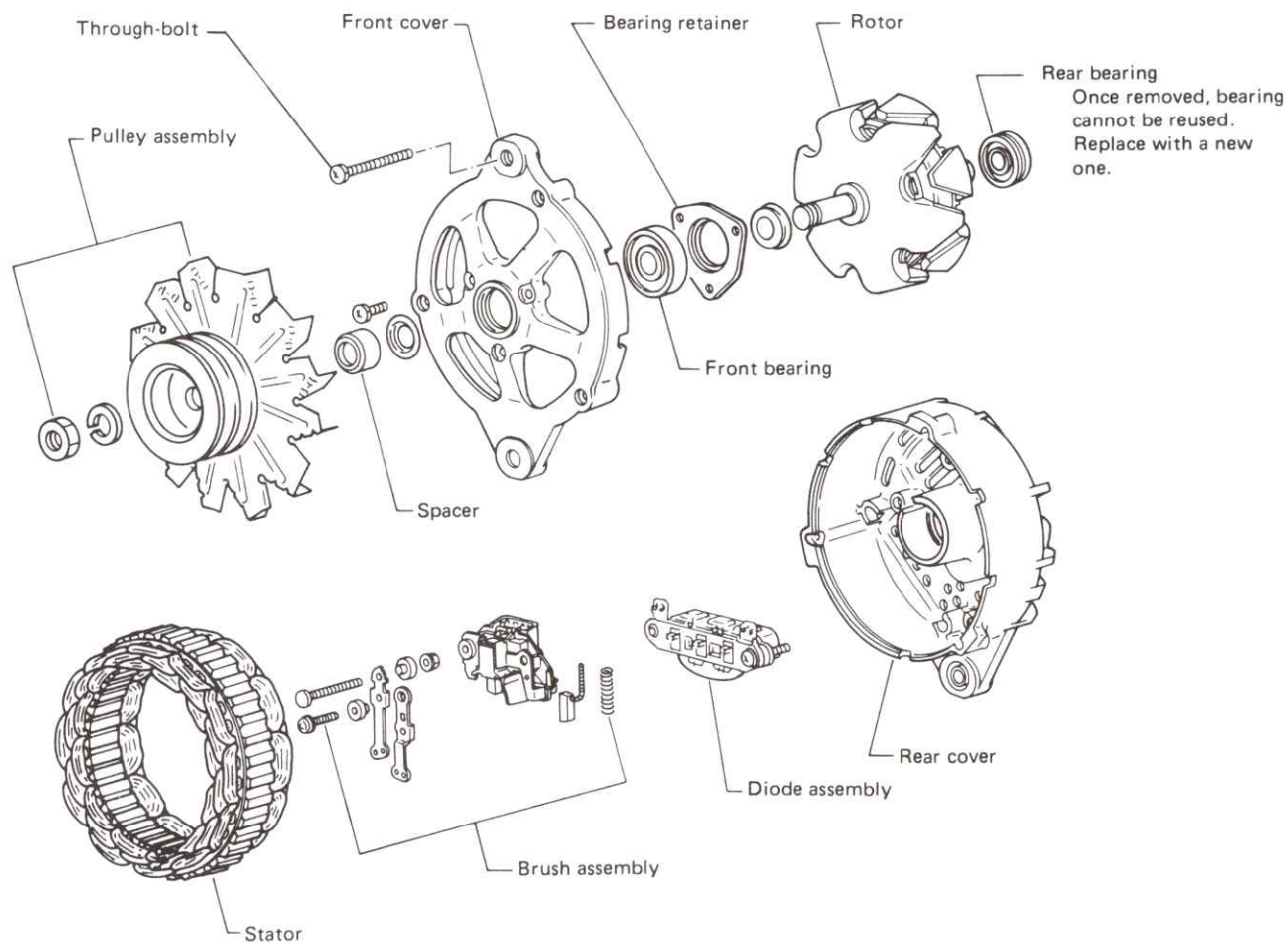


Fig. 12.2 Exploded view of the alternator (Sec 6)

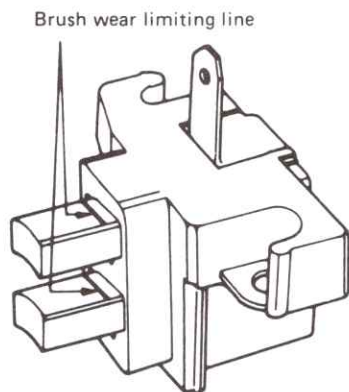


Fig. 12.3 Alternator brush wear limit line (Sec 6)

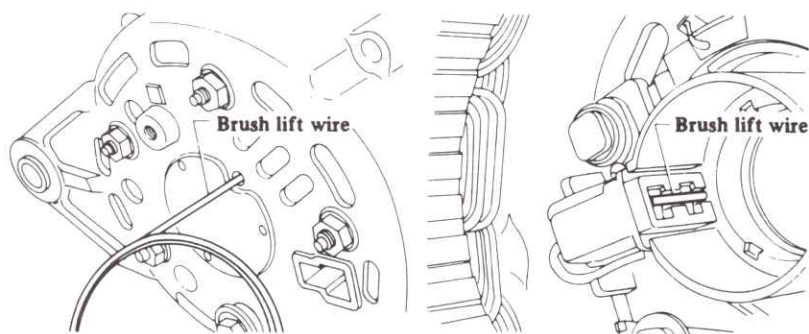


Fig. 12.4 Using a brush lift wire (Sec 6)

- 7 Unless the voltage regulator is faulty ignore the operations described in the next three paragraphs.
- 8 Remove the regulator securing rivets and unsolder the terminals (photo).
- 9 Remove the bolts which retain the brush holder/regulator unit.
- 10 Refit the new regulator by reversing the disconnection and removal operations. Peen the rivets securely.
- 11 Before reassembling the rear cover/brush holder assembly to the motor/front cover, the brushes must be held in the raised position in order to be able to locate them on the slip rings. Do this by passing a thin rod through the hole provided in the alternator rear cover (photo).
- 12 Align the marks made on the front and rear covers and join the sections of the alternator together.
- 13 Fit the tie-bolts, remove the temporary brush lift rod.
- 14 If for any reason the alternator pulley must be removed, the pulley retaining nut can be unscrewed if the rotor shaft is prevented from rotating by inserting a splined socket in the shaft recess or by gripping the rotor in a vice with the alternator dismantled.

## 7 Starter motor – description

- 1 The starter motor is of pre-engaged type.
- 2 When the starter switch is operated, current flows from the battery to the solenoid switch which is mounted on the starter body. The plunger in the solenoid moves inwards, so causing a centrally pivoted lever to push the drive pinion into mesh with the starter ring gear. When the solenoid plunger reaches the end of its travel, it closes an internal contact and full starting current flows to the starter field coils. The armature is then able to rotate the crankshaft, so starting the engine.
- 3 A special freewheel clutch is fitted to the starter drive pinion so that as soon as the engine fires and starts to operate on its own it does not drive the starter motor.
- 4 When the starter switch is released, the solenoid is de-energised and a spring moves the plunger back to its rest position. This operates the pivoted lever to withdraw the drive pinion from engagement with the starter ring.
- 5 On automatic transmission models, an idler gear is incorporated at the drive end of the starter motor.

## 8 Starter motor – testing in situ

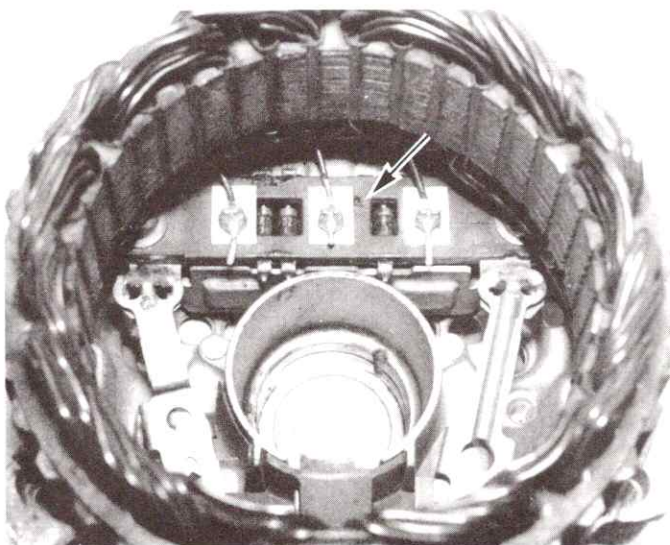
- 1 If the starter motor fails to turn the engine when the switch is operated there are five possible causes:

- (a) *The battery is faulty*
- (b) *The electrical connections between the switch, solenoid battery and starter motor are somewhere failing to pass the necessary current from the battery through the starter to earth*
- (c) *The solenoid switch is faulty*
- (d) *The starter motor is mechanically or electrically defective*
- (e) *The starter motor pinion and/or flywheel ring gear is badly worn and in need of replacement*

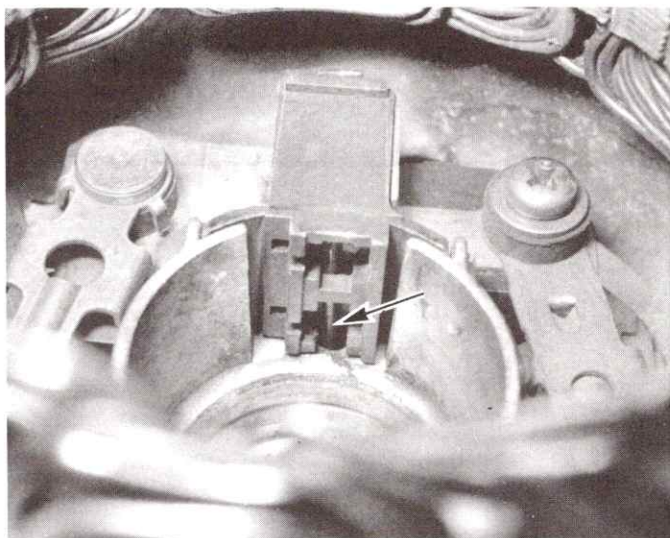
- 2 To check the battery, switch on the headlight. If they dim after a few seconds the battery is in a discharged state. If the lights glow brightly, operate the starter switch and see what happens to the lights. If they dim then you know that power is reaching the starter motor but failing to turn it. If the starter turns slowly when switched on, proceed to the next check.

- 3 If, when the starter switch is operated, the lights stay bright, then insufficient power is reaching the motor. Remove the battery connections, starter/solenoid power connections and the engine earth strap and thoroughly clean them and refit them. Smear petroleum jelly around the battery connections to prevent corrosion. Corroded connections are the most frequent cause of electric system malfunctions.

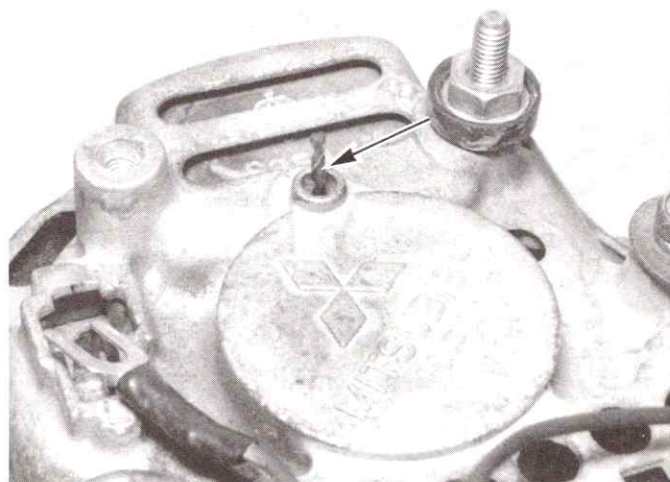
- 4 When the above checks and cleaning tasks have been carried out, but without success, you will possibly have heard a clicking noise each time the starter switch was operated. This was the solenoid switch operating, but it does not necessarily follow that the main contacts were closing properly (if no clicking has been heard from the solenoid, it is certainly defective). The solenoid contact can be checked by putting a voltmeter or bulb across the main cable connection of the



6.8 View inside alternator showing regulator



6.11A Using a drill as a brush holder ...



6.11B ... through this hole

starter side of the solenoid and earth. When the switch is operated, there should be a reading or lighted bulb. If there is no reading or lighted bulb, the solenoid unit is faulty and should be renewed.

5 If the starter motor operates but doesn't turn the engine over then it is most probable that the starter pinion and/or flywheel ring gear are badly worn, in which case the starter motor will normally be noisy in operation.

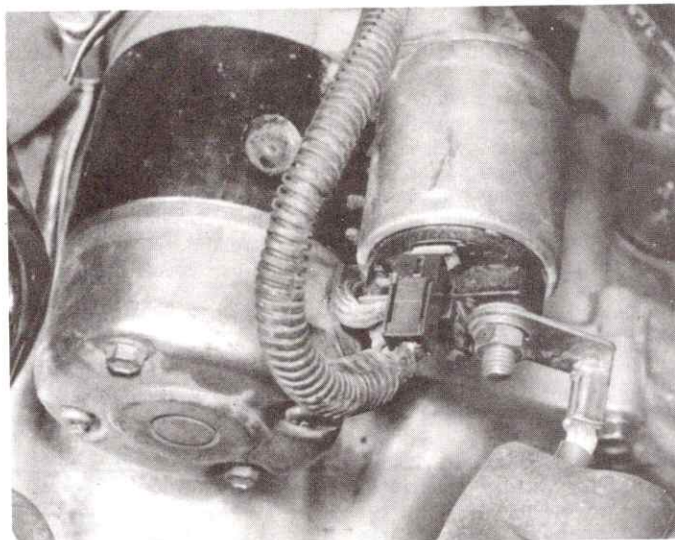
6 Finally, if it is established that the solenoid is not faulty and 12 volts are getting to the starter, then the motor is faulty and should be removed for inspection.

## 9 Starter motor – removal and refitting

- 1 Disconnect the battery.
- 2 Disconnect the leads from the starter motor and solenoid terminals (photo).
- 3 Unscrew the starter motor fixing bolts and lift the unit from the engine.
- 4 Refitting is a reversal of removal.

## 10 Starter motor – overhaul

- 1 Such is the inherent reliability and strength of the starter motors fitted, it is very unlikely that a motor will need dismantling until it is totally worn out and in need of replacement as a whole.
- 2 If, however, the motor is only a couple of years old and a pinion carriage, solenoid system or brush fault is suspected then remove the motor from the engine and dismantle as described in the following paragraphs.



9.2 Starter motor electrical connections

- 3 Extract the screws and remove the solenoid by tilting it to release its plunger from the shift lever. Retain the torsion spring and adjusting plate.
- 4 Prise off the rear cover dust cap.
- 5 Prise off the E-ring (Fig. 12.7) and remove the thrust washers.

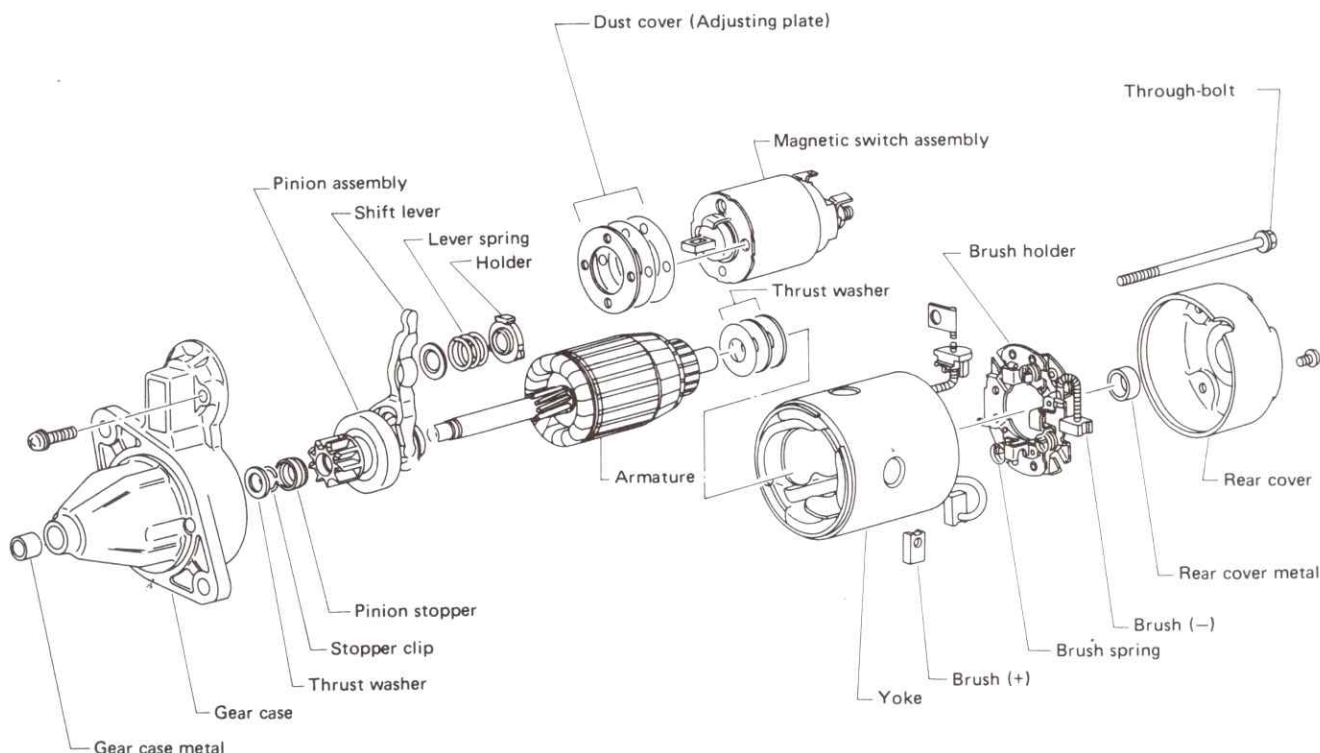


Fig. 12.5 Exploded view of starter motor for manual transmission (Sec 10)

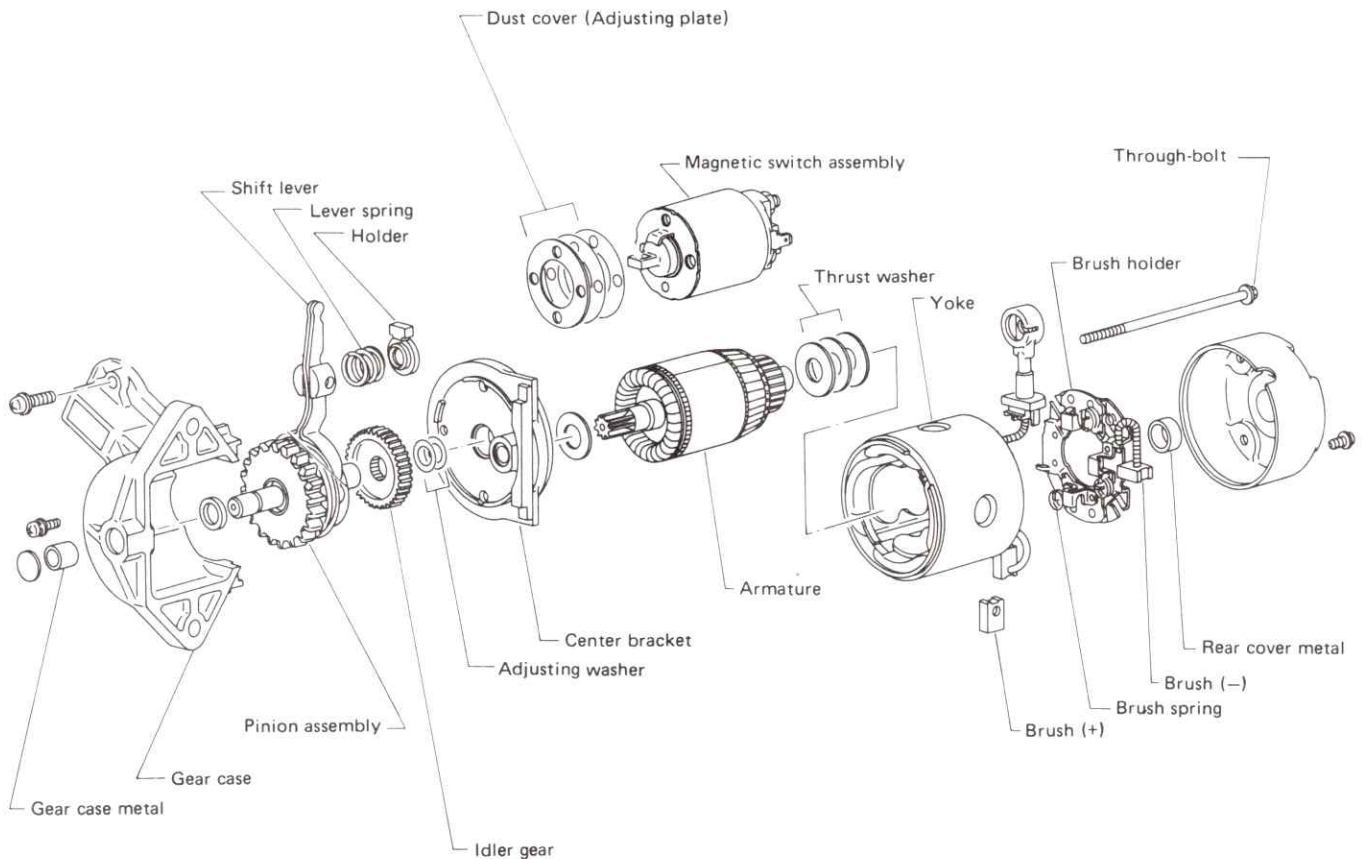


Fig. 12.6 Exploded view of starter motor for automatic transmission (Sec 10)

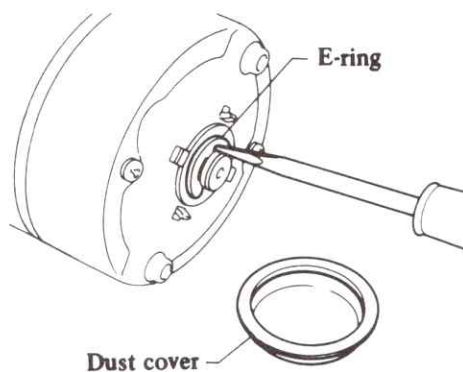


Fig. 12.7 Starter motor dust cap and E-ring (Sec 10)

6 Remove the brush holder screws and the tie-bolts, and withdraw the rear cover.

7 Remove the brush holder. To do this, pull the brush springs upwards and partially withdraw the brushes. If the springs are now released they will apply pressure to the side of the brushes and retain them in the partially withdrawn position.

8 Withdraw the yoke.

9 Withdraw the armature and shift lever from the drive end housing.  
10 To remove the drive assembly from the armature shaft, tap the stop ring down the shaft to expose the circlip.

11 Prise the circlip from its groove, pull the stop ring off the shafts.

12 Remove the drive pinion assembly from the shaft.

13 On automatic transmission models remove the idler gear by prising out the E-ring and dust cap and driving out the idler shaft. Note which way round the gear is fitted.

14 With the motor dismantled, inspect all the components for wear.

15 If the commutator appears dirty or burned, clean it with a solvent-soaked rag and, if necessary, burnish it with very fine glass paper.

16 If the segment insulators are flush with the surface of the segments, then the insulators must be undercut, as shown in Fig. 12.8. Use a thin hacksaw blade, or similar, and make sure that the undercut corners are square.

17 If an ohmmeter is available, test the armature for continuity between adjacent segments. The insulation can be tested by placing one probe of the test instrument on the armature shaft and the other on each segment in turn. If continuity is found to exist, the armature must be renewed.

18 Now check for continuity between the field coil positive terminal and the positive brush. If it does not exist, the field coils will have to be renewed.

19 Check the insulation by connecting one probe of the test instrument to the field coil positive terminal and the yoke. If continuity exists, the field coils must be renewed.

20 Renewal of the starter motor field coils is a job best left to your

## Undercut procedures

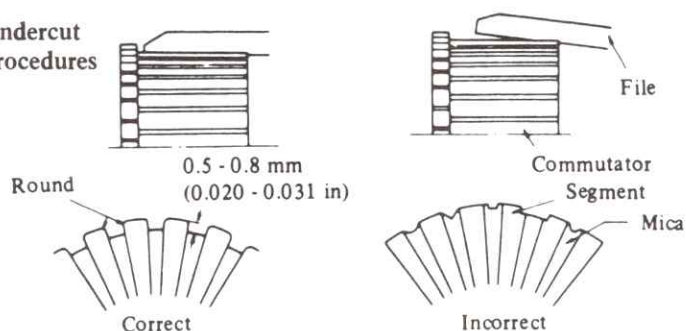


Fig. 12.8 Starter motor commutator undercut (Sec 10)

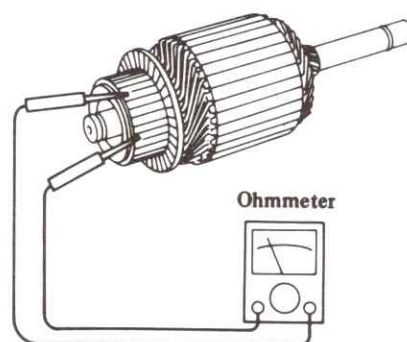


Fig. 12.9 Testing starter motor armature for continuity (Sec 10)

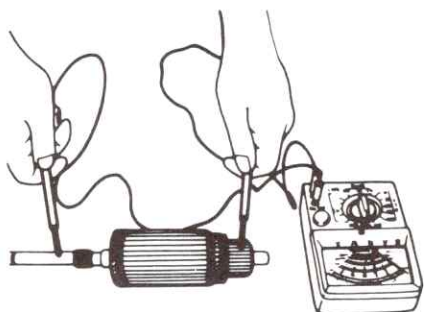


Fig. 12.10 Testing starter armature insulation (Sec 10)

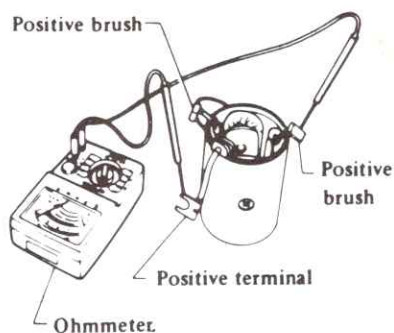


Fig. 12.11 Testing starter field coil for continuity (Sec 10)

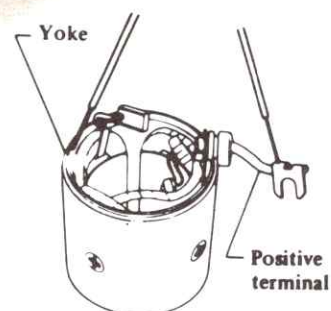


Fig. 12.12 Testing starter field coil insulation (Sec 10)

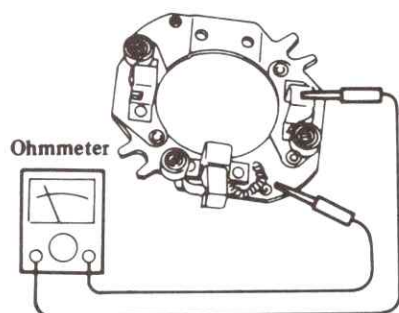


Fig. 12.13 Testing starter brush holder insulation (Sec 10)

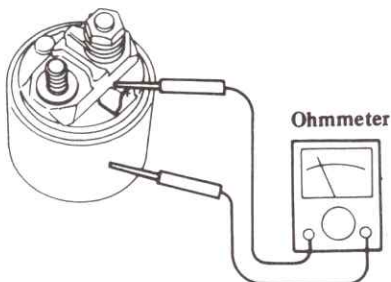
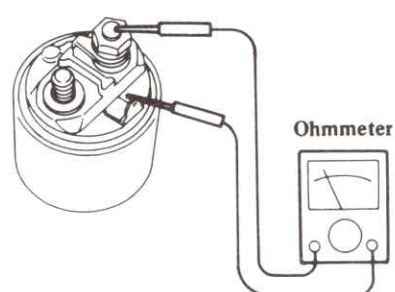


Fig. 12.14 Testing starter solenoid switch for continuity (Sec 10)



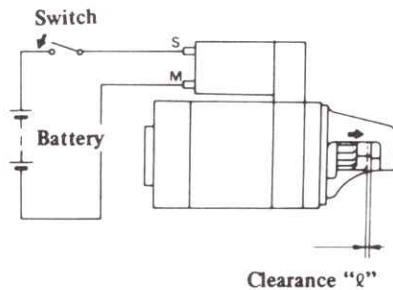


Fig. 12.15 Starter pinion setting diagram – manual transmission (Sec 10)

Clearance 0.5 to 2.0 mm (0.020 to 0.079 in)

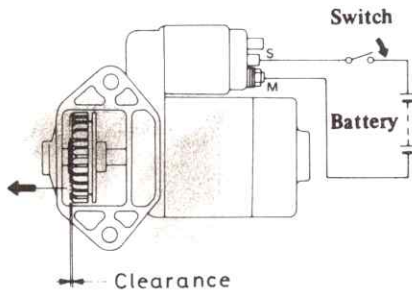


Fig. 12.16 Starter pinion setting diagram – automatic transmission (Sec 10)

Clearance difference = 0.5 to 2.0 mm (0.020 to 0.079 in)

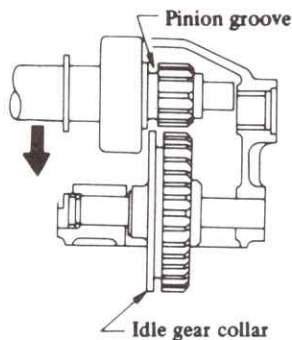


Fig. 12.17 Starter pinion-to-idler gear relationship – automatic transmission (Sec 10)

dealer or auto-electrical agent due to the need for a pressure screwdriver and other equipment.

21 Check the brushes for wear. If they have worn down to the minimum specified length, renew them by removing the old brush lead and soldering on the new. Carry out the work quickly to avoid the spread of heat to the field coils, and do not allow the solder to seep down the lead or its flexibility will be impaired.

22 The brush holder can be checked for insulation breakdown by placing one probe of the tester on the positive side of the brush holder and the other one on the negative (baseplate) side. If continuity is indicated, renew the brush holder.

23 The solenoid switch can be checked for continuity by connecting the test instrument between the S terminal and the switch body. If no continuity is indicated, renew the switch.

24 Now place the probes of the tester on the S and M terminals of the switch. If no continuity is indicated, renew the switch.

25 Finally check the teeth of the drive pinion and idler gear, (where applicable). If they are worn or chipped renew the component. Test the pinion/clutch assembly for correct operation. It should turn smoothly in the drive direction and lock when turned in the reverse direction.

26 Reassemble by reversing the dismantling procedure. Lightly grease the friction surfaces, bushes, bearings and pivots as work proceeds.

27 On automatic transmission models, make sure that the idler gear is fitted the right way round with its collar opposite the groove in the pinion.

28 The pinion projection should now be checked by connecting the solenoid to a 12V battery to actuate it.

29 On manual transmission models, the clearance between the face of the pinion and the stop plate should be as specified in the Specifications at the beginning of this Chapter. If it is not, change the adjustment plate under the solenoid switch for one of different thickness. The plates are available in thickness of 0.5 mm (0.020 in) and 0.8 mm (0.031 in).

30 On automatic transmission models, with the solenoid actuated, measure the projection of the front face of the idler gear. Now measure again when the idler gear is pulled out by hand. The difference between the two measurements should be within the specified tolerance. If it is not, change the adjusting plate for one of suitable thickness.

## 11 Fuses, fusible links and relays – general

### Fuses

1 The fusebox (photo) is located inside the vehicle under the right-hand side of the fascia panel on RHD models, left-hand side on LHD models.

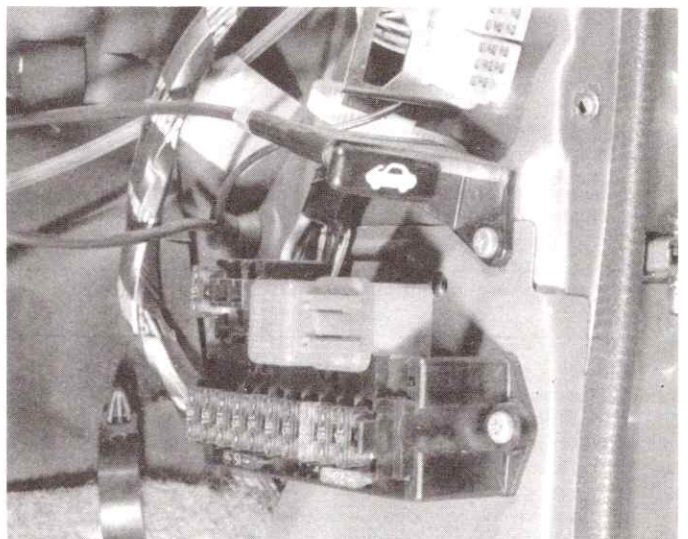
2 Place the fingers under the fusebox cover and pull it off.

3 The fuses are of 10 to 20A rating according to the circuit which is protected.

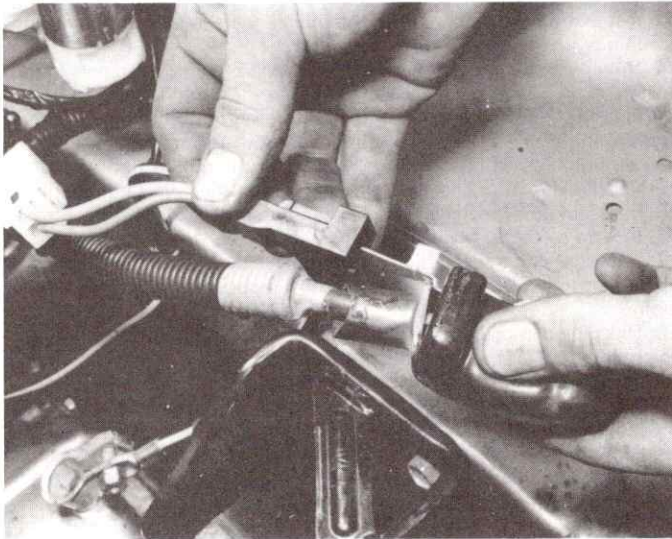
4 A blown fuse can be detected visually and should be renewed with one of the same amperage.

5 If the new fuse blows immediately, suspect a short circuit, probably faulty insulation, which should be rectified at once.

6 Never substitute a fuse of higher amperage, or a piece of wire or foil as a means of preventing a fuse blowing, this could lead to a fire or severely damage the components of the circuit.



11.1 Fuse box



11.7 Fusible link on battery terminal

### Fusible links

- 7 These are designed to melt in the event of a short in a major current carrying circuit (photo).
- 8 The links must never be taped up or placed in contact with adjacent wiring, plastic or rubber parts.
- 9 Before renewing a melted fusible link, rectify the cause or have a thorough check carried out on the vehicle wiring harness.
- 10 The circuits which the fusible links supply are shown in the wiring diagrams at the end of the manual.

### Relays

- 11 The number and purpose of the relays fitted depends upon the particular model vehicle and its equipment.
- 12 The flasher unit is located under the fascia panel next to the steering column.
- 13 The ignition and accessory relays are located on top of the fusebox.
- 14 At the front corners of the engine compartment relays may be located which actuate the following:

*Air conditioner*  
*Air conditioner condenser fan*  
*Horn*  
*Headlamp dimmer*  
*Rear foglamp*  
*Automatic choke*  
*Transmission switch*

- 15 On the engine compartment rear bulkhead a relay may be located which actuates the windscreen wiper (intermittent)

## 12 Steering column combination switch – removal and refitting

- 1 Remove the steering wheel as described in Chapter 10, Section 16. Also remove the steering column shrouds (Chapter 10, Section 17).
- 2 The combination switch assembly consists of four basic units which can be removed and fitted independently of each other. They are: lighting switch, wash/wipe switch, hazard switch and the switch base.
- 3 Each unit may be removed by unscrewing the retaining screws (photo) and disconnecting the electrical leads.
- 4 To remove the switch base, remove the switch clamp screw, push the unit down, and turn it clockwise, then lift it off the column.
- 5 Refitting the switch base or any units is a reversal of removal.

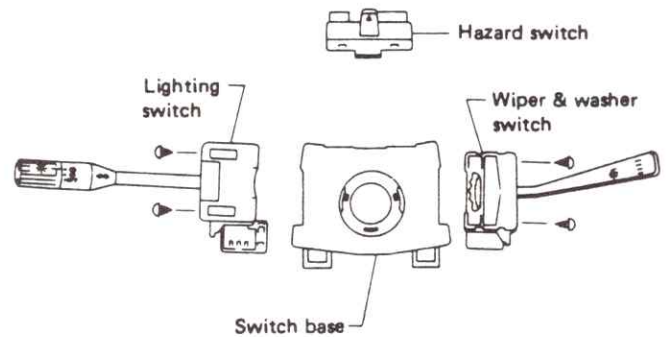
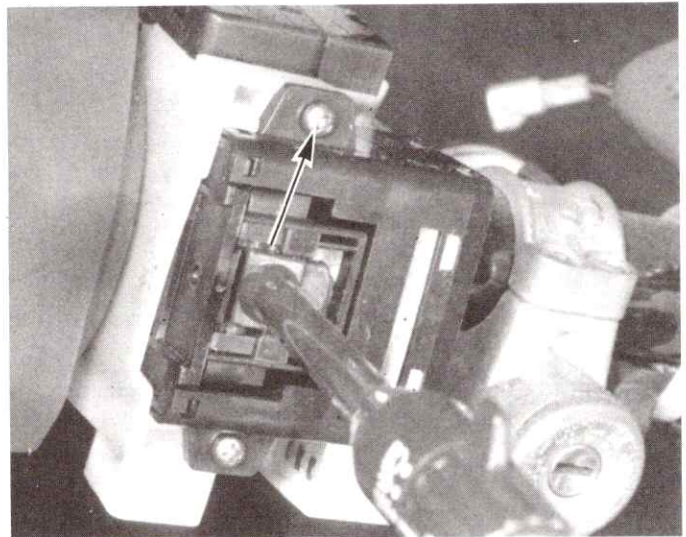


Fig. 12.18 Components of the combination switch (Sec 12)



12.3 Typical switch unit attachment screws

## 13 Courtesy lamp – removal and refitting

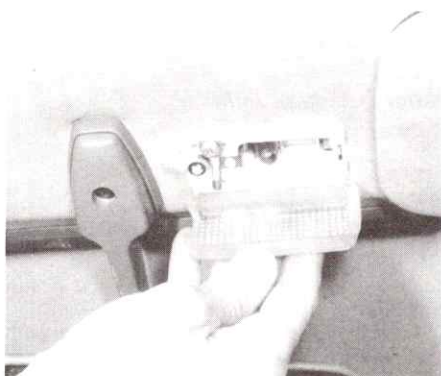
- 1 The courtesy lamp is fitted above the windscreen by the rear view mirrors (photo).
- 2 Snap off the cover to replace a bulb.
- 3 Remove the securing screw to release the base plate. Make sure the electrical supply lead does not disappear inside the roof panel while the base plate is removed.
- 4 Refitting is a reversal of removing.

## 14 Facia panel mounted switches – removal and refitting

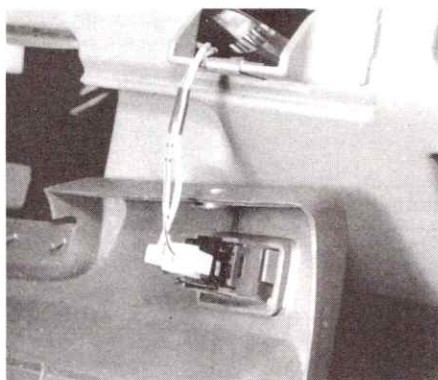
- 1 These switches are held in place by plastic tabs.
- 2 They can be removed by reaching up behind the facia panel, depressing the tags and pulling the switch out (photo).
- 3 Disconnect the electrical supply leads and remove the switch.
- 4 Refitting is a reversal of removal.

## 15 Headlamp bulbs – removal and refitting

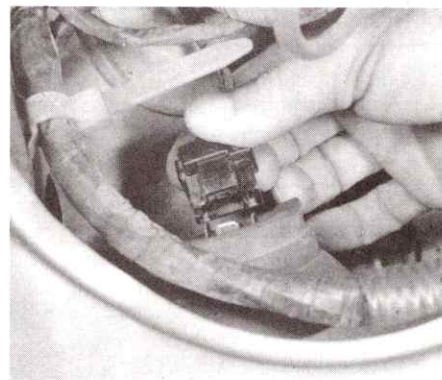
- 1 The headlamp bulb may be changed from inside the engine compartment.



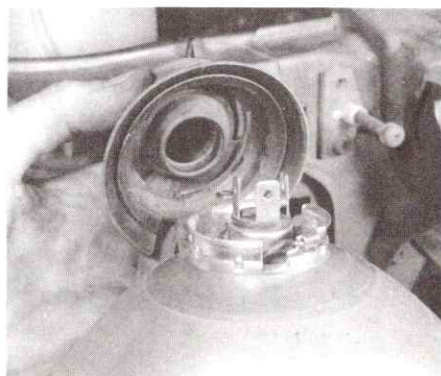
13.1 Courtesy lamp



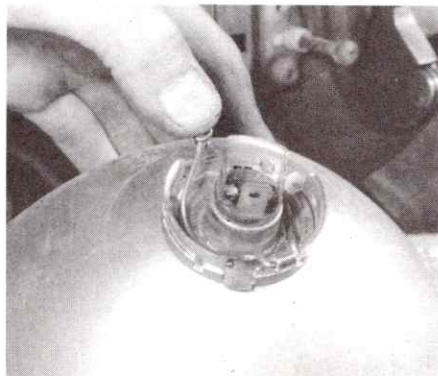
14.2 Showing the rear of a facia switch



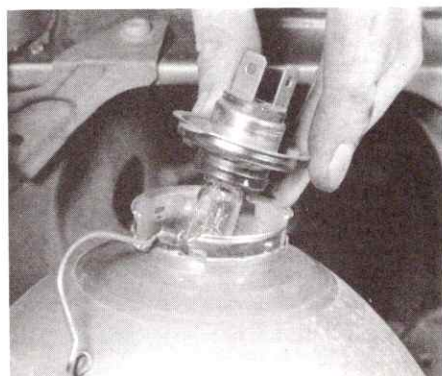
15.2 Remove the connector



15.3 Remove the dust cover



15.4 Release the spring clip



15.5 Lift out the bulb

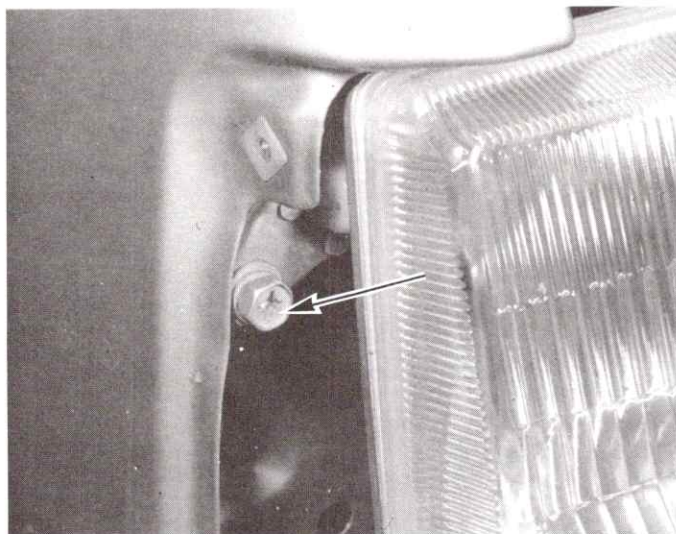
- 2 Lift the bonnet and then pull off the electrical connector (photo).
- 3 Lift off the dust cover (photo).
- 4 Unhook the spring retainer (photo).
- 5 Lift out the bulb (photo).

**Note:** Do not handle halogen bulbs, as deposits from fingers will shorten the bulb's life.

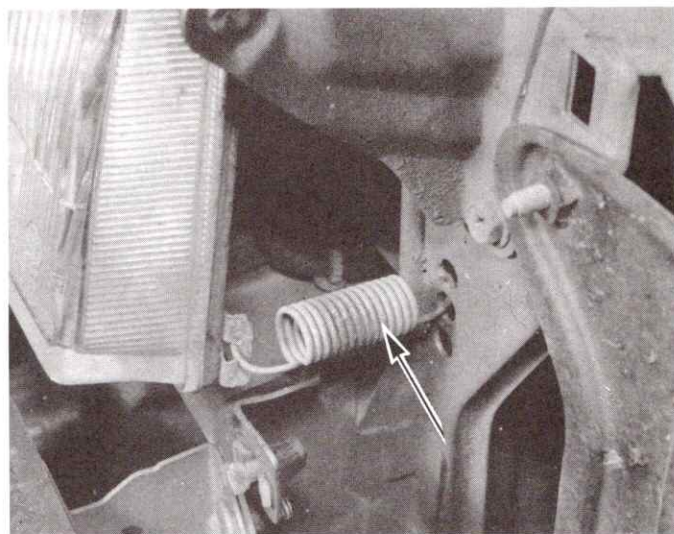
- 6 Refit in the reverse order.

## 16 Headlamp unit – removal and refitting

- 1 Remove the front combination light unit described in Section 18.
- 2 Remove the front radiator grille as described in Chapter 11.
- 3 Remove the headlamp retaining bolt (photo).
- 4 Unhook the tensioning spring (photo) and remove the headlamp unit.



16.3 Remove the headlamp retaining bolt



16.4 Unhook the tensioning spring

## 17 Headlamp beam adjustment

Although adjustment screws are provided for setting the headlamp beam, it is recommended that this operation be left to your local dealer or garage who has the necessary equipment.

## 18 Combination light – removal, refitting and bulb changing

### Front combination light

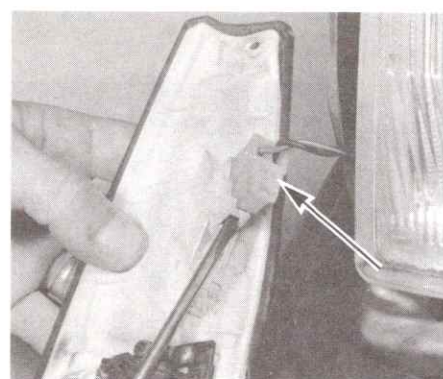
- 1 Remove the top retaining screw (photo).
- 2 Pull the unit out at the top, and unhook it from the plastic retaining clip at the bottom (photo).
- 3 Depress the plastic catch and pull off the connector (photo).



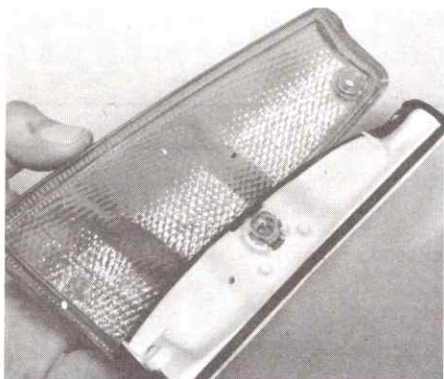
18.1 Remove the top securing screw



18.2 Unhook the bottom end from the retaining clip



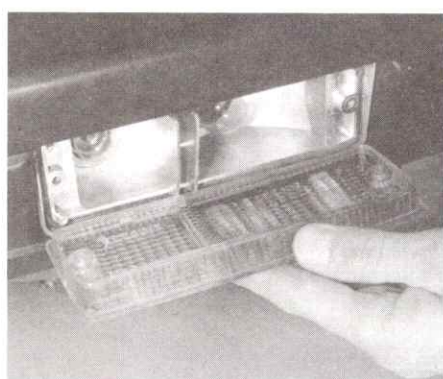
18.3 Remove the connector



18.4 Prise off the lens



18.6 Remove the two screws



18.7 Pull off the lens

- 4 Prise open the lens, revealing the bulb, which is of the bayonet type fixing (photo).
- 5 Refit in the reverse order.

### Front marker and direction indicator lights

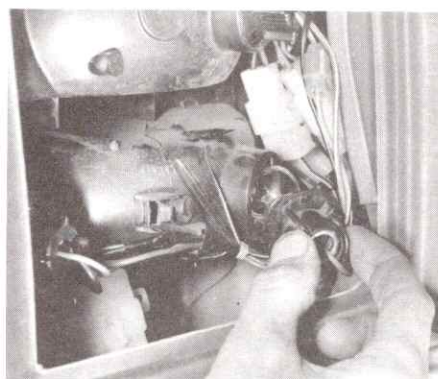
- 6 Remove the two retaining screws (photo).
- 7 Pull off the lens (photo).
- 8 The bulbs are a bayonet fix.
- 9 Refit in the reverse order.

### Rear combination lights

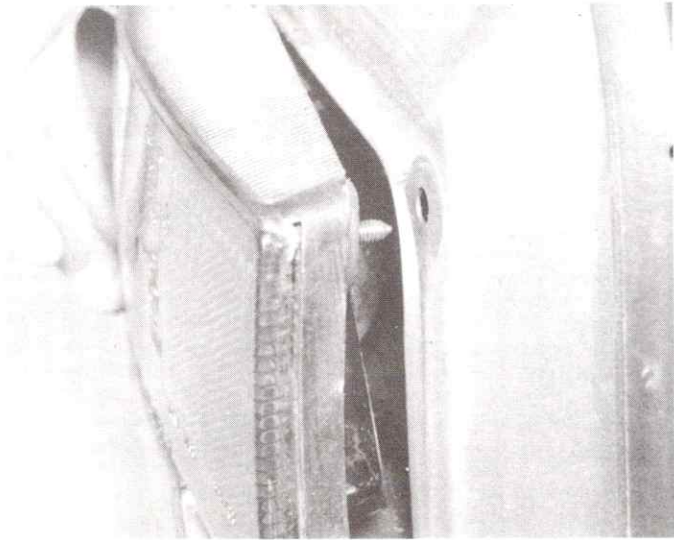
- 10 The bulbs in the rear combination light unit may be changed in situ by removing the plastic cover in the luggage compartment (photo).
- 11 This will reveal the back of the unit. The bulbholders twist and pull out and the bulbs are a bayonet fix (photo).



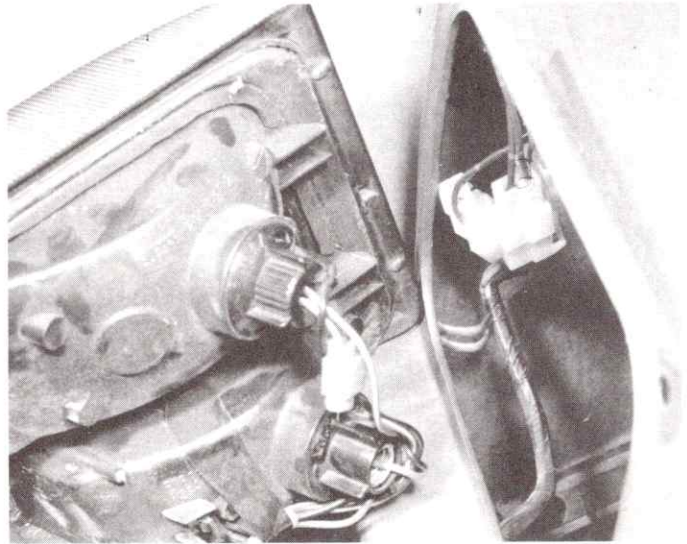
18.10 Remove the plastic panel



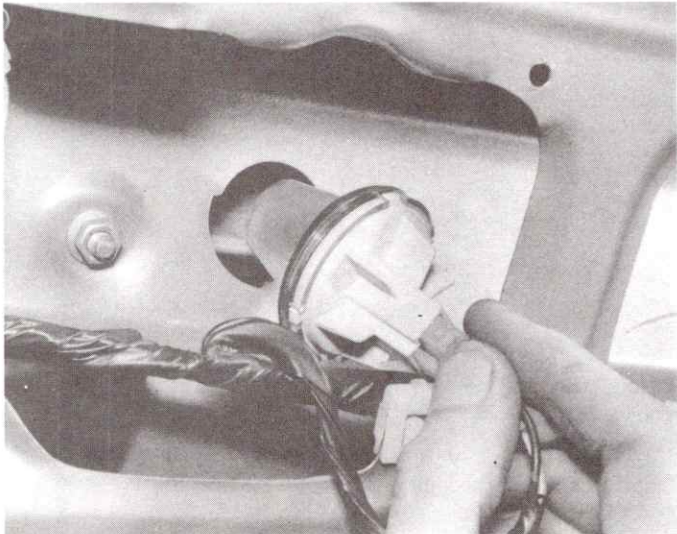
18.11 Removing the bulbholders



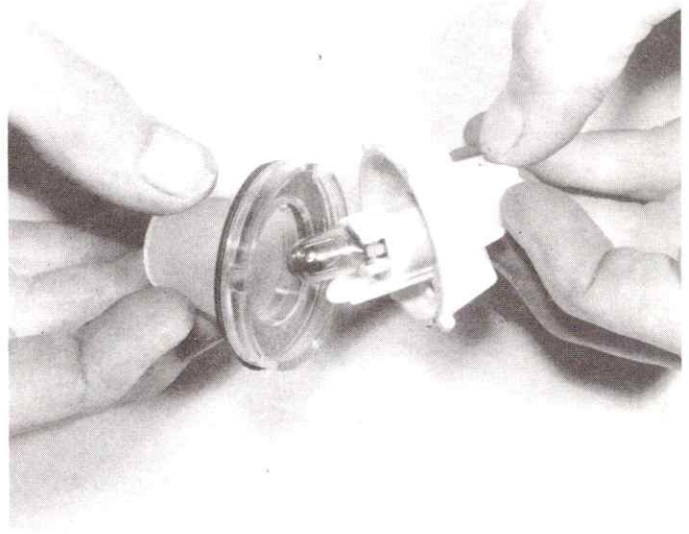
18.12 Removing the lens cover



18.13 Outboard edge has locating lugs



18.16 Removing the rear number plate light from the tailgate



18.17 Separating the cover from the holder

12 To remove the light unit, undo the two nuts from the inboard edge of the unit by reaching inside the luggage compartment, and pull the unit outwards (photo).

13 The outboard edge has locating lugs to hold it in place (photo).

14 Refit in the reverse order.

#### *Number plate light*

15 The rear number plate light can be reached by removing the trim covering the inside of the tailgate.

16 Twist and pull the lamp unit from its housing (photo).

17 Twist off the lamp cover (photo). The bulb is a push fit in the holder.

18 Refit in the reverse order.

### **19 Instrument panel – removal and refitting**

1 The term 'instrument panel' refers to that part of the complete facia assembly which is immediately above the steering column, and houses the speedometer and gauges. Instructions for removing the complete facia panel will be found in Chapter 11.

2 Remove the steering wheel as described in Chapter 10 if necessary for better access; otherwise remove the column shrouds.

3 Remove the screws holding the instrument panel shroud (photo).

4 Remove the screws holding the instrument panel to the facia (photo).

5 Pull the panel forward gently and then disconnect the speedometer cable (photo). Do this by depressing the plastic clip and pulling the cable from its housing. It is a push fit on refitting.

6 The panel will now come further forward allowing the electrical connectors to be disconnected, and the panel removed (photo).

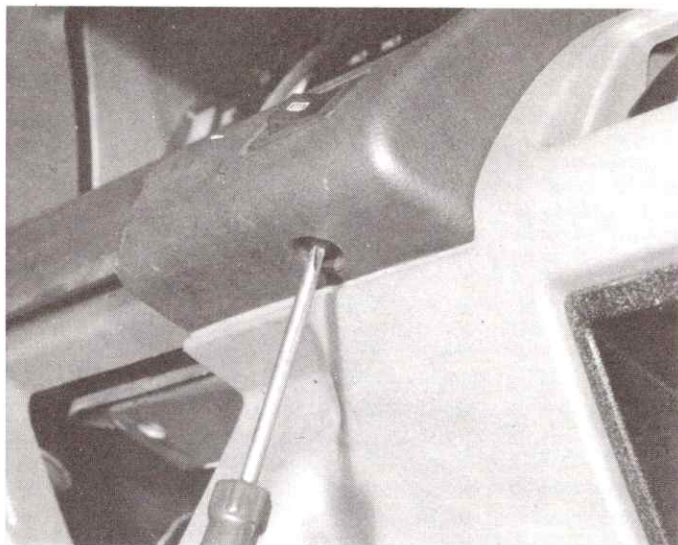
7 The perspex cover may be removed by depressing the plastic clips (photo).

8 Further clips hold the panel surround (photo).

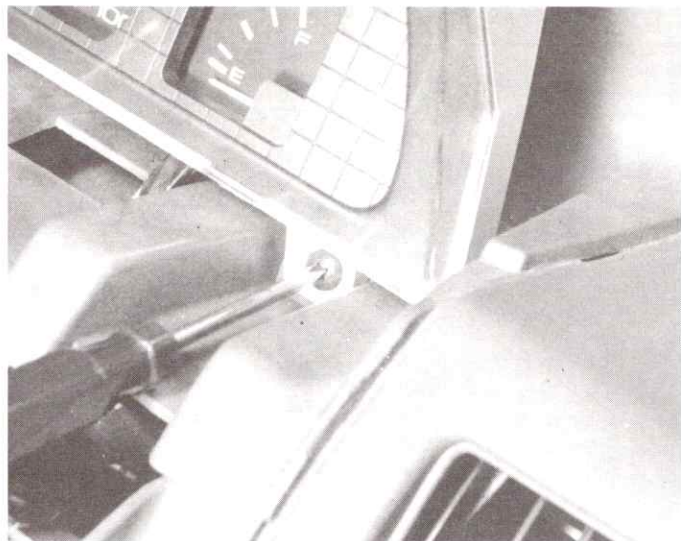
9 The instruments themselves (photo) may be removed by pulling off the plastic backing sheet (photo) and removing the nuts (photo).

10 The instrument bulbs are a push fit in the holders, and can be pulled out for renewal (photos). The holders are a bayonet fit in the instrument panel. Note that it is usually possible to remove these bulbs and holders from the rear without it being necessary to remove the instrument panel.

11 Refitting is a reversal of this procedure.



19.3 Instrument panel shroud screws



19.4 Removing the instrument panel to facia screws

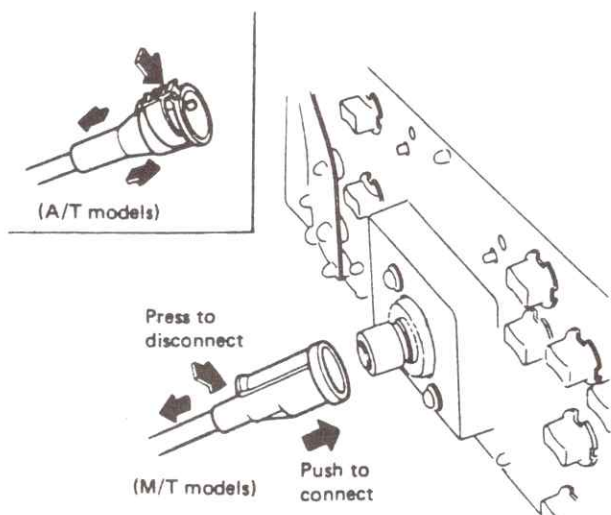
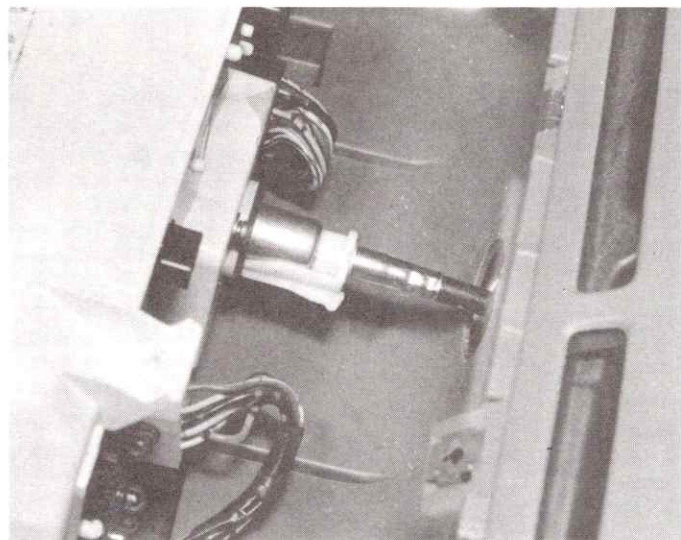
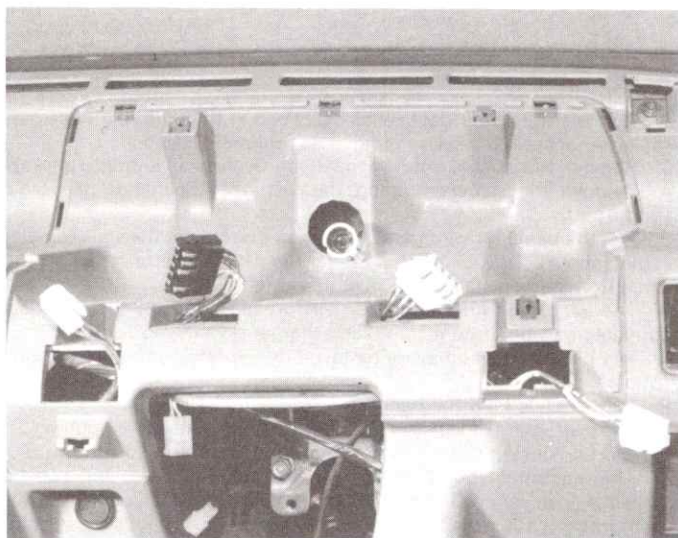


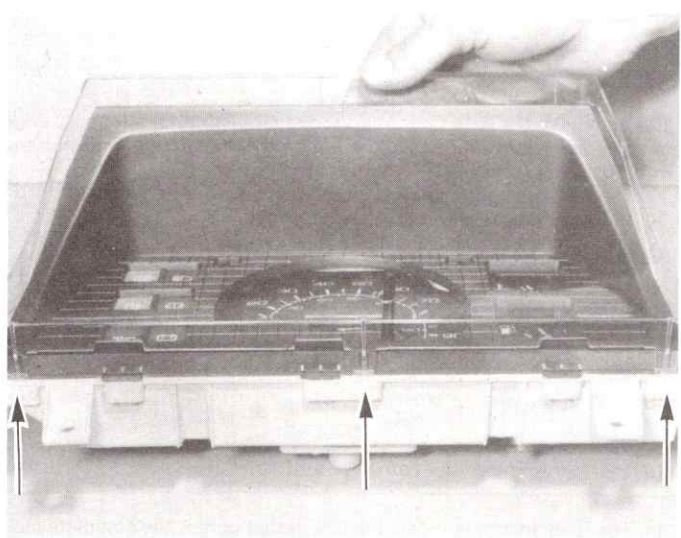
Fig. 12.19 Removing the speedometer cable (Sec 19)



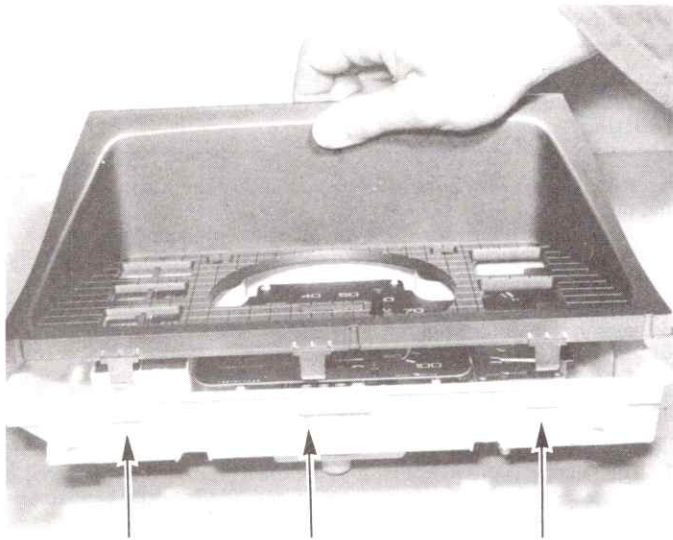
19.5 Pull out the speedometer cable



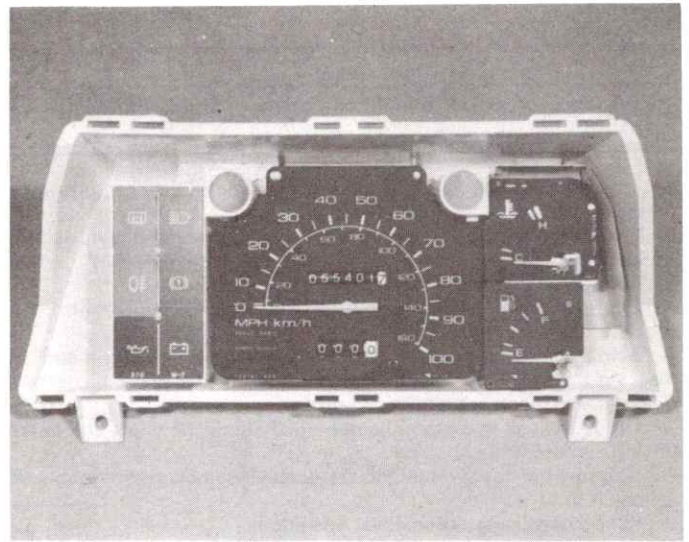
19.6 Instrument panel removed



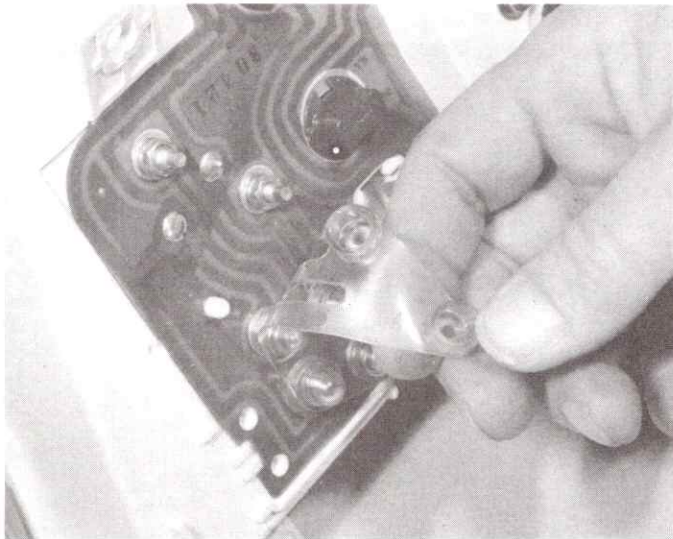
19.7 Removing the perspex cover ...



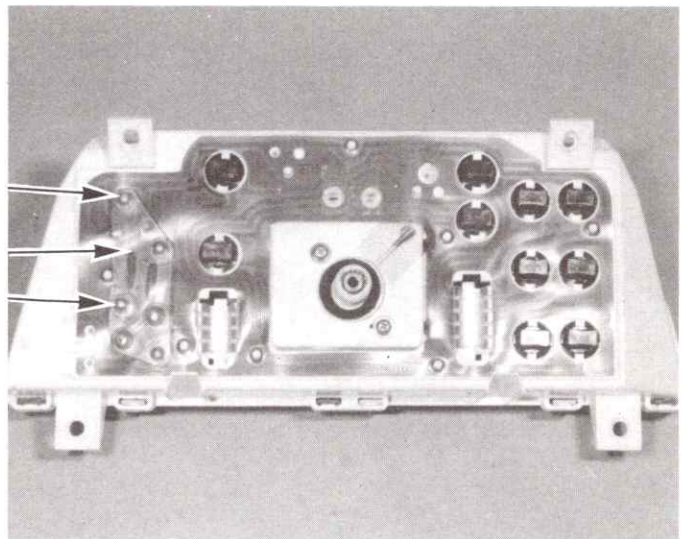
19.8 ... and instrument panel surround



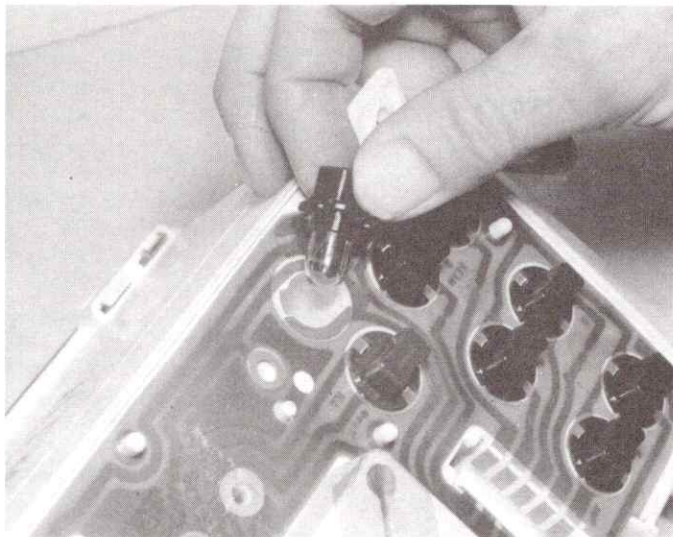
19.9A Showing the instruments ...



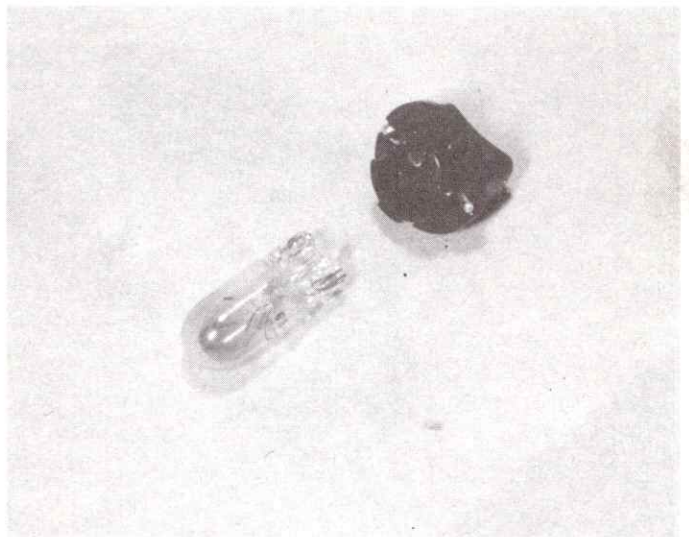
19.9B ... plastic locking sheet ...



19.9C ... and instrument securing nuts



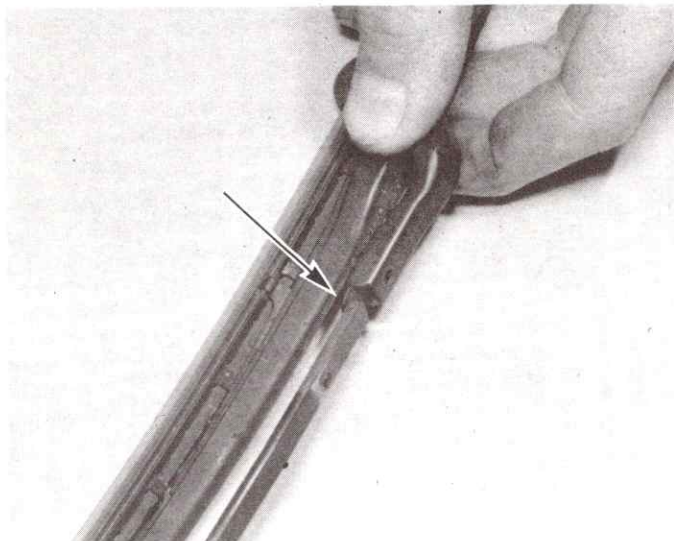
19.10A The bulbs ...



19.10B ... are a push fit

### 20 Windscreen wiper blades and arms – removal and refitting

- 1 The wiper blades should be renewed as soon as they cease to wipe the glass cleanly.
- 2 The complete blade assembly or just the rubber insert are available as replacements.
- 3 Pull the wiper arm from the glass until it locks.
- 4 Depress the small tab and slide the blade off the arm (photo).
- 5 Refitting is a reversal of removal.
- 6 Before removing a wiper arm, it is worthwhile sticking a strip of masking tape on the glass against the edge of the wiper blade as a guide to wiper arm setting when refitting.
- 7 Lift up the cap to expose the nut which holds the wiper arm to the driving spindle (photo).
- 8 Unscrew the nut and pull the arm/blade assembly from the spindle splines.
- 9 Refit by reversing the removal operations.
- 10 Wet the glass and operate the wipers to check their arc of travel. If it is incorrect, remove the arm and move it a spline or two in the required direction.



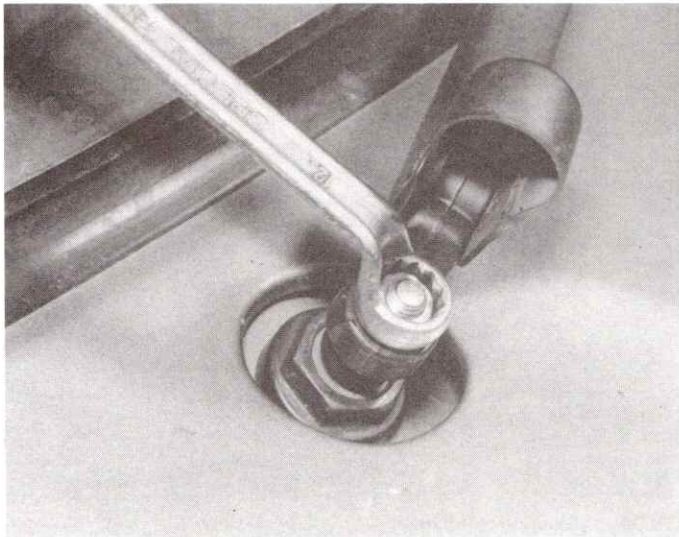
20.4 Removing windscreen wiper blade

### 21 Windscreen wiper motor and linkage – removal and refitting

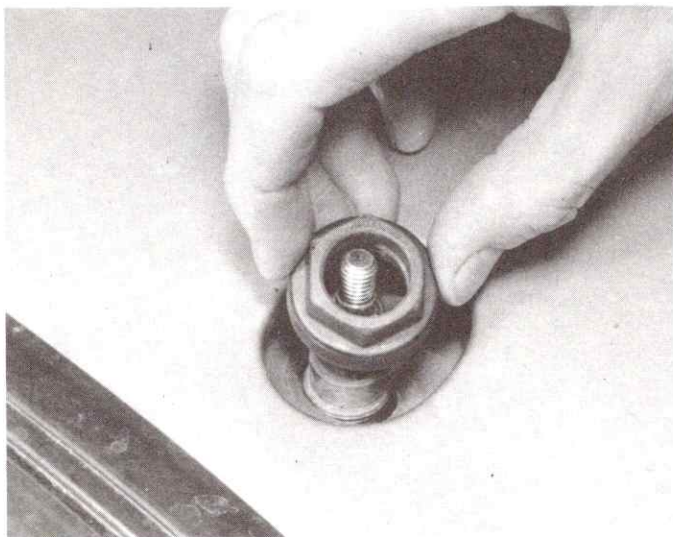
- 1 Remove the wiper arms as described in Section 20 and disconnect the battery.
- 2 Remove the wiper drive spindle nut from both spindles (photo).
- 3 Remove the air intake grille held by screws (photo) at its rear edge and locating tabs (photo) on its front edge.
- 4 Prise off the wiper link arms (photos).
- 5 Unbolt the motor from the engine bulkhead (photo).
- 6 Refitting is a reversal of these operations.

### 22 Tailgate wiper motor – removal and refitting

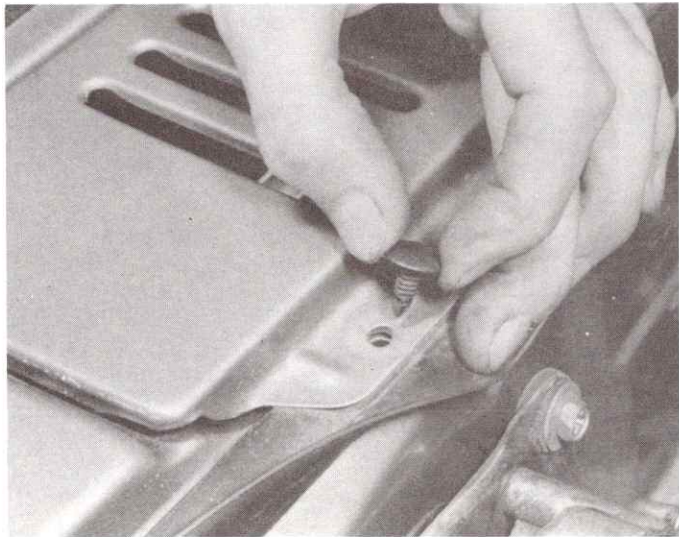
- 1 The tailgate wiper motor is of direct drive type, without linkages.
- 2 The wiper arm/blade is removed as described for the windscreen wiper in Section 20.
- 3 Open the tailgate and remove the trim panel by carefully prising out the clips. Disconnect the battery.
- 4 Disconnect the wiper motor wiring.



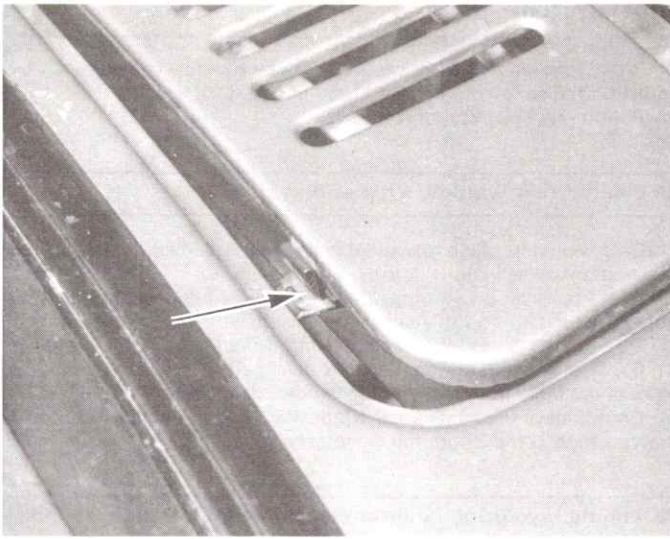
20.7 Removing the arm from drive spindle



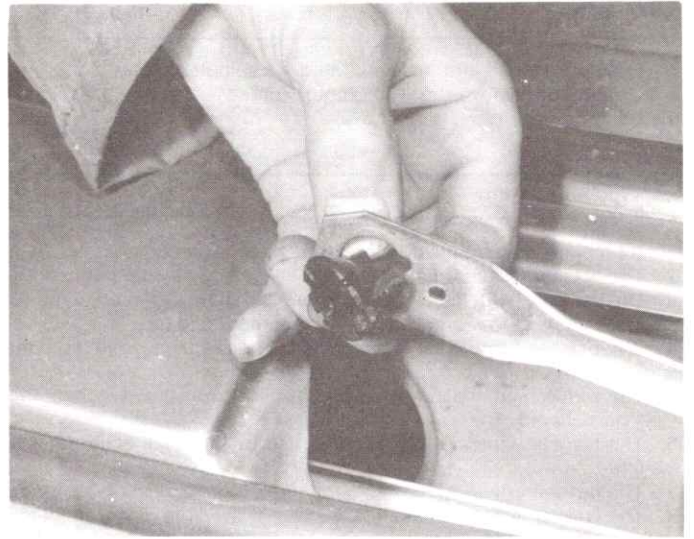
21.2 Removing the wiper drive spindle nut



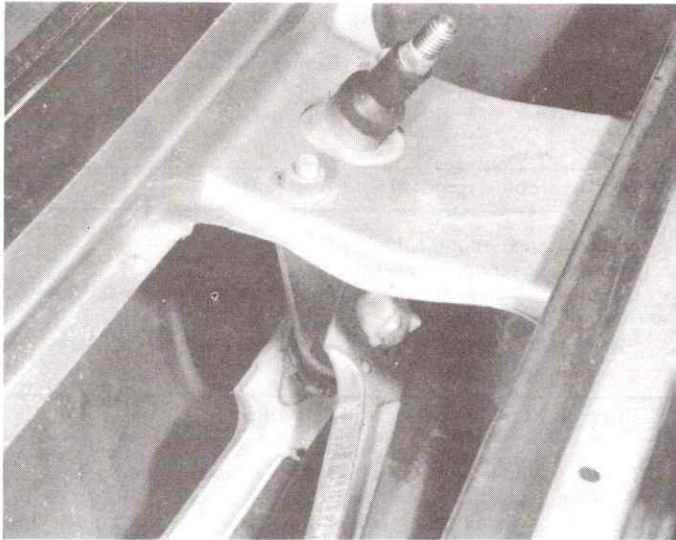
21.3A Air intake grille screws ...



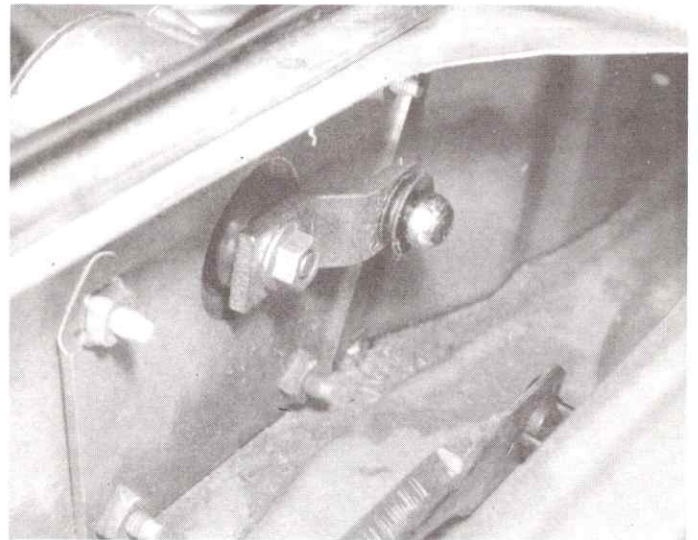
21.3B ... and location tabs



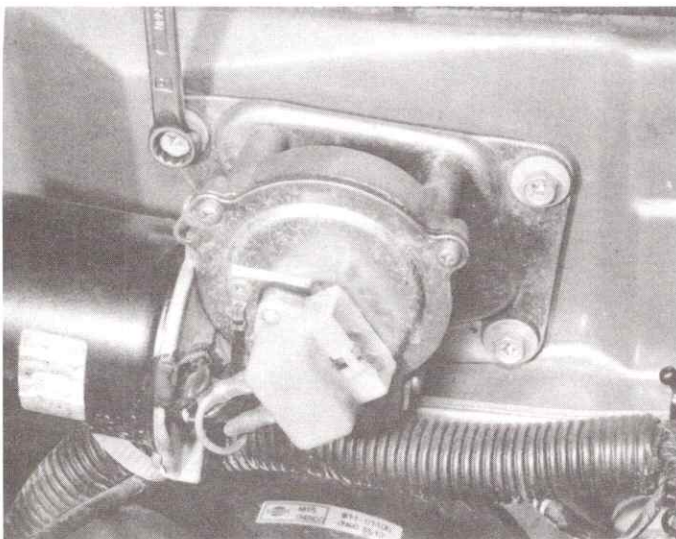
21.4A Prise the link arms ...



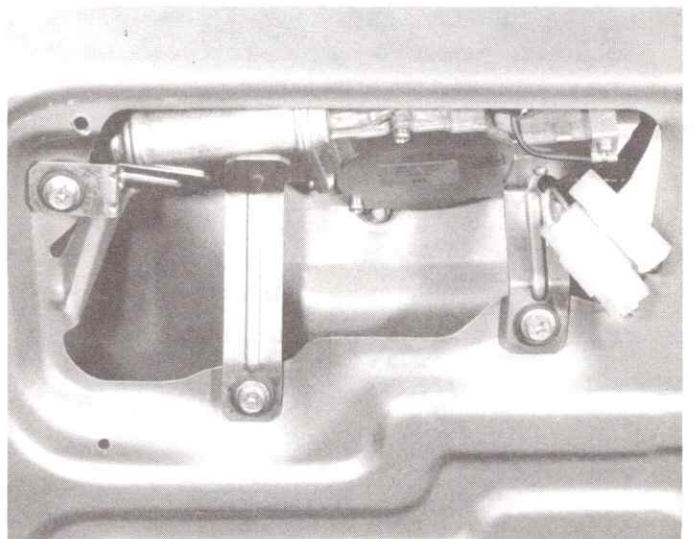
21.4B ... from the other components ...



21.4C ... of the wiper linkage



21.5 Unbolting the motor from the bulkhead



22.6 The tailgate wiper motor

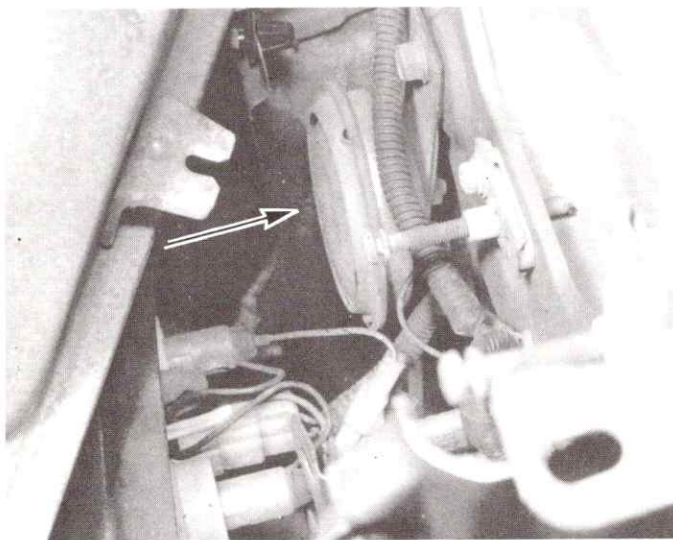
- 5 Prise off the cap and unscrew the drive spindle nut.
- 6 Unbolt and remove the wiper motor (photo).
- 7 Refitting is a reversal of removal.

### 23 Washer system – general

- 1 All models are equipped with a windscreen washer
- 2 The washer reservoir is located within the engine compartment.
- 3 On vehicles with a tailgate washer, the fluid reservoir with its electric pumps serves both the windscreen and tailgate.
- 4 Where a headlamp washer system is fitted, a separate fluid reservoir is used.
- 5 The windscreen wiper/washer is controlled by a stalk switch on the steering column.
- 6 The tailgate wiper/washer is controlled by a double action rocker switch.
- 7 The headlamp washer switch is of single action rocker type.
- 8 The washer jets which are located within the slots of the air intake grille are adjusted by inserting a pin in their nozzles and repositioning them to give a satisfactory spray pattern.

### 24 Horn – removal and refitting

- 1 Remove the headlamp unit as described in Section 16.
- 2 Unbolt the horn from the bracket and disconnect the wiring (photo).



24.2 The horn is situated behind the headlamp

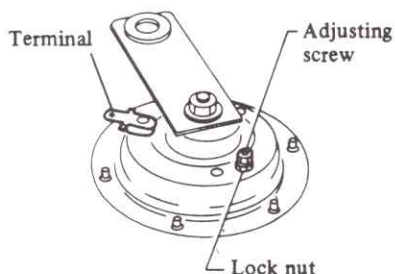


Fig. 12.20 Adjusting screw on the horn (Sec 24)

- 3 If the horn emits a weak sound it may be possible to improve it by adjusting the screw on the rear of the unit.
- 4 Refitting is a reversal of removal.

### 25 Heated rear window – general

- 1 Care should be taken to avoid damage to the element for the heated rear window or tailgate (photo).
- 2 Avoid scratching with rings on the fingers when cleaning, and do not allow luggage to rub against the glass.
- 3 Do not stick labels over the element on the inside of the glass.
- 4 If the element grids do become damaged, a special conductive paint is available from most motor factors to repair it.
- 5 Do not leave the heated rear window switch on unnecessarily as it draws a high current from the electrical system.

### 26 Engine revolution counter electronic unit – removal and refitting

**Note:** These units are fitted to all models, but only operate when a tachometer is also fitted

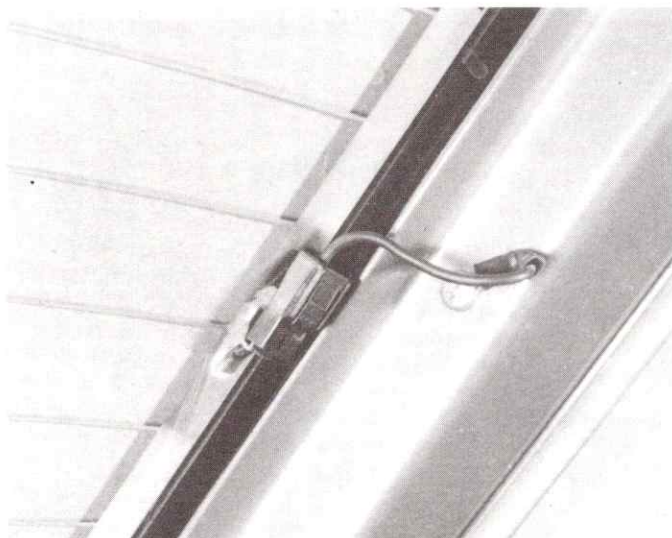
- 1 The engine revolution counter electronic control unit is situated under the front passenger seat (photo).
- 2 To remove it, disconnect the electrical lead and remove the two screws securing it to the floor pan.
- 3 Refit in the reverse order.

### 27 Digital clock – removal and refitting

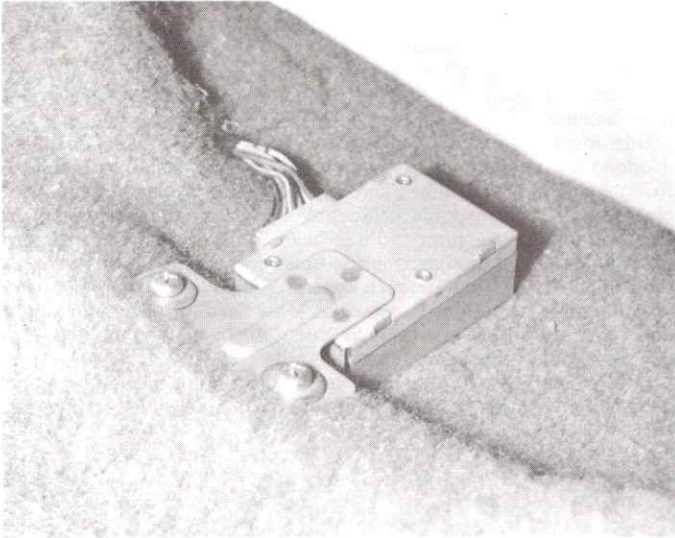
- 1 Prise off the surround (photo).
- 2 Undo the securing screws (photo).
- 3 Disconnect the electrical lead (photo) and lift the clock from the housing.
- 4 Refitting is a reversal of this procedure.

### 28 Cigar lighter – removal and refitting

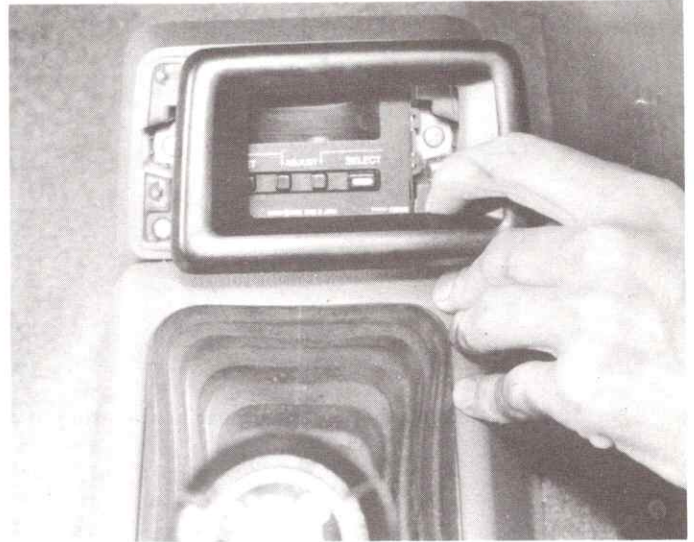
- 1 The cigar lighter is contained within the heater control panel.
- 2 Prise out the heater control panel front as described in Chapter 11.
- 3 Disconnect the electrical lead and unscrew the cigar lighter from the panel.
- 4 Refit in the reverse order.



25.1 Heated rear screen elements and electrical connection



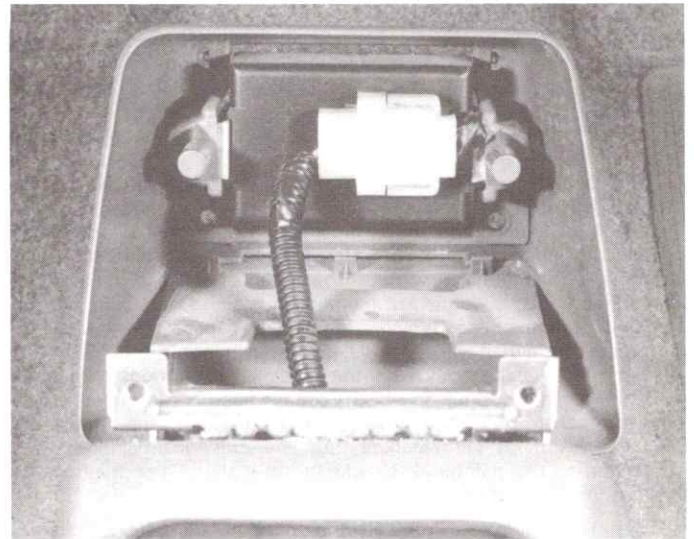
26.1 Engine revolution counter electronic unit



27.1 Prise off the surround



27.2 Undo the screws ...



27.3 ... and electrical connector

## 29 Mobile radio equipment – interference-free installation

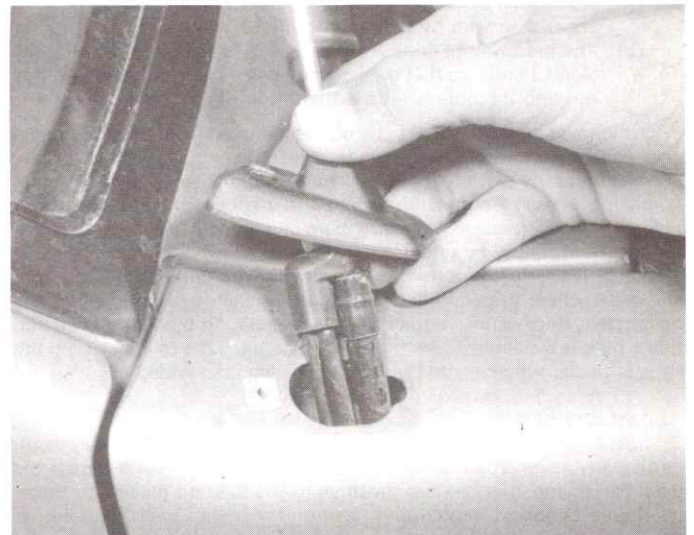
### *Aerials – selection and fitting*

The choice of aerials is now very wide. It should be realised that the quality has a profound effect on radio performance, and a poor, inefficient aerial can make suppression difficult.

A wing-mounted aerial is regarded as probably the most efficient for signal collection, but a roof aerial is usually better for suppression purposes because it is away from most interference fields. Stick-on wire aerials are available for attachment to the inside of the windscreen, but are not always free from the interference field of the engine and some accessories.

Motorised automatic aerials rise when the equipment is switched on and retract at switch-off. They require more fitting space and supply leads, and can be a source of trouble.

There is no merit in choosing a very long aerial as, for example, the type about three metres in length which hooks or clips on to the rear of the car, since part of this aerial will inevitably be located in an interference field. For VHF/FM radios the best length of aerial is about one metre. Active aerials have a transistor amplifier mounted at the



29.1 Removing the aerial

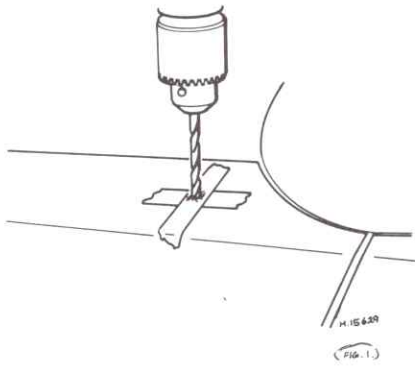


Fig. 12.21 Drilling the bodywork for aerial mounting (Sec 29)

base and this serves to boost the received signal. The aerial rod is sometimes rather shorter than normal passive types.

A large loss of signal can occur in the aerial feeder cable, especially over the Very High Frequency (VHF) bands. The design of feeder cable is invariably in the co-axial form, ie a centre conductor surrounded by a flexible copper braid forming the outer (earth) conductor. Between the inner and outer conductors is an insulator material which can be in solid or stranded form. Apart from insulation, its purpose is to maintain the correct spacing and concentricity. Loss of signal occurs in this insulator, the loss usually being greater in a poor quality cable. The quality of cable used is reflected in the price of the aerial with the attached feeder cable.

The capacitance of the feeder should be within the range 65 to 75 picofarads (pF) approximately (95 to 100 pF for Japanese and American equipment), otherwise the adjustment of the car radio aerial trimmer may not be possible. An extension cable is necessary for a long run between aerial and receiver. If this adds capacitance in excess of the above limits, a connector containing a series capacitor will be required, or an extension which is labelled as 'capacity-compensated'.

Fitting the aerial will normally involve making a  $\frac{1}{8}$  in (22 mm) diameter hole in the bodywork, but read the instructions that come with the aerial kit. Once the hole position has been selected, use a centre punch to guide the drill. Use sticky masking tape around the area for this helps with marking out and drill location, and gives protection to the paintwork should the drill slip. Three methods of making the hole are in use:

- Use a hole saw in the electric drill. This is, in effect, a circular hacksaw blade wrapped round a former with a centre pilot drill.
- Use a tank cutter which also has cutting teeth, but is made to shear the metal by tightening with an Allen key.
- The hard way of drilling out the circle is using a small drill, say  $\frac{1}{8}$  in (3 mm), so that the holes overlap. The centre metal drops out and the hole is finished with round and half-round files.

Whichever method is used, the burr is removed from the body metal and paint removed from the underside. The aerial is fitted tightly ensuring that the earth fixing, usually a serrated washer, ring or clamp, is making a solid connection. *This earth connection is important in reducing interference.* Cover any bare metal with primer paint and topcoat, and follow by underseal if desired.

Aerial feeder cable routing should avoid the engine compartment and areas where stress might occur, eg under the carpet where feet will be located. Roof aerials require that the headlining be pulled back and that a path is available down the door pillar. It is wise to check with the vehicle dealer whether roof aerial fitting is recommended.

### Loudspeakers

Speakers should be matched to the output stage of the equipment, particularly as regards the recommended impedance. Power transistors used for driving speakers are sensitive to the loading placed on them.

Before choosing a mounting position for speakers, check whether the vehicle manufacturer has provided a location for them. Generally door-mounted speakers give good stereophonic reproduction, but not

all doors are able to accept them. The next best position is the rear parcel shelf, and in this case speaker apertures can be cut into the shelf, or pod units may be mounted.

For door mounting, first remove the trim, which is often held on by 'poppers' or press studs, and then select a suitable gap in the inside door assembly. Check that the speaker would not obstruct glass or winder mechanism by winding the window up and down. A template is often provided for marking out the trim panel hole, and then the four fixing holes must be drilled through. Mark out with chalk and cut cleanly with a sharp knife or keyhole saw. Speaker leads are then threaded through the door and door pillar, if necessary drilling 10 mm diameter holes. Fit grommets in the holes and connect to the radio or tape unit correctly. Do not omit a waterproofing cover, usually supplied with door speakers. If the speaker has to be fixed into the metal of the door itself, use self-tapping screws, and if the fixing is to the door trim use self-tapping screws and flat spire nuts.

Rear shelf mounting is somewhat simpler but it is necessary to find gaps in the metalwork underneath the parcel shelf. However,

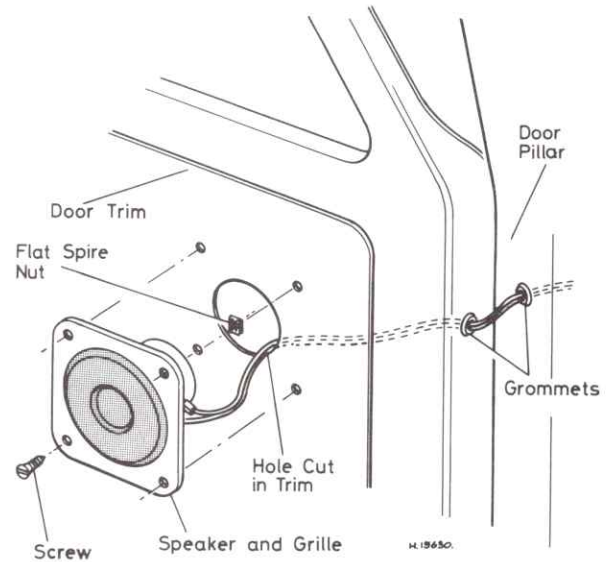


Fig. 12.22 Door-mounted speaker installation (Sec 29)

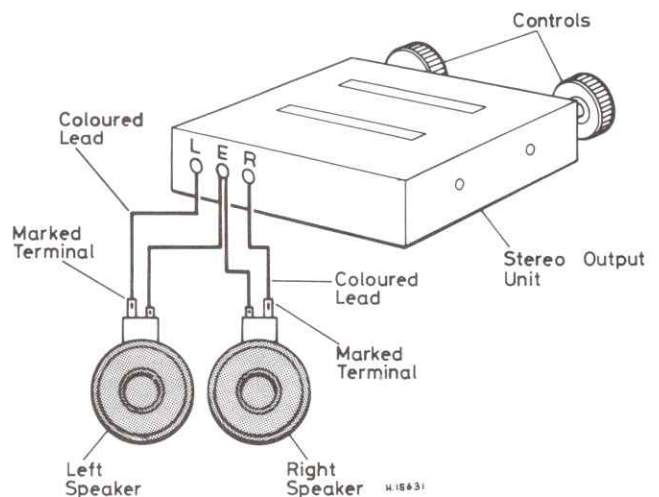


Fig. 12.23 Speaker connections must be correctly made as shown (Sec 29)

remember that the speakers should be as far apart as possible to give a good stereo effect. Pod-mounted speakers can be screwed into position through the parcel shelf material, but it is worth testing for the best position. Sometimes good results are found by reflecting sound off the rear window.

### Unit installation

Many vehicles have a dash panel aperture to take a radio/audio unit, a recognised international standard being 189.5 mm x 60 mm. Alternatively a console may be a feature of the car interior design and this, mounted below the dashboard, gives more room. If neither facility is available a unit may be mounted on the underside of the parcel shelf; these are frequently non-metallic and an earth wire from the case to a good earth point is necessary. A three-sided cover in the form of a cradle is obtainable from car radio dealers and this gives a professional appearance to the installation; in this case choose a position where the controls can be reached by a driver with his seat belt on.

Installation of the radio/audio unit is basically the same in all cases, and consists of offering it into the aperture after removal of the knobs (*not* push buttons) and the trim plate. In some cases a special mounting plate is required to which the unit is attached. It is worthwhile supporting the rear end in cases where sag or strain may occur, and it is usually possible to use a length of perforated metal strip attached between the unit and a good support point nearby. In general it is recommended that tape equipment should be installed at or nearly horizontal.

Connections to the aerial socket are simply by the standard plug terminating the aerial downlead or its extension cable. Speakers for a stereo system must be matched and correctly connected, as outlined previously.

**Note:** While all work is carried out on the power side, it is wise to disconnect the battery earth lead. Before connection is made to the vehicle electrical system, check that the polarity of the unit is correct. Most vehicles use a negative earth system, but radio/audio units often have a reversible plug to convert the set to either + or - earth. *Incorrect connection may cause serious damage.*

The power lead is often permanently connected inside the unit and terminates with one half of an in-line fuse carrier. The other half is fitted with a suitable fuse (3 or 5 amperes) and a wire which should go to a power point in the electrical system. This may be the accessory terminal on the ignition switch, giving the advantage of power feed with ignition or with the ignition key at the 'accessory' position. Power to the unit stops when the ignition key is removed. Alternatively, the lead may be taken to a live point at the fusebox with the consequence of having to remember to switch off at the unit before leaving the vehicle.

Before switching on for initial test, be sure that the speaker connections have been made, for running without load can damage the output transistors. Switch on next and tune through the bands to ensure that all sections are working, and check the tape unit if applicable. The aerial trimmer should be adjusted to give the strongest reception on a weak signal in the medium wave band, at say 200 metres.

### Interference

In general, when electric current changes abruptly, unwanted electrical noise is produced. The motor vehicle is filled with electrical devices which change electric current rapidly, the most obvious being the contact breaker.

When the spark plugs operate, the sudden pulse of spark current causes the associated wiring to radiate. Since early radio transmitters used sparks as a basis of operation, it is not surprising that the car radio will pick up ignition spark noise unless steps are taken to reduce it to acceptable levels.

Interference reaches the car radio in two ways:

- (a) by conduction through the wiring.
- (b) by radiation to the receiving aerial.

Initial checks presuppose that the bonnet is down and fastened, the radio unit has a good earth connection (*not* through the aerial downlead outer), no fluorescent tubes are working near the car, the aerial trimmer has been adjusted, and the vehicle is in a position to receive radio signals, i.e. not in a metal-clad building.

Switch on the radio and tune it to the middle of the medium wave (MW) band off-station with the volume (gain) control set fairly high. Switch on the ignition (but do not start the engine) and wait to see if

irregular clicks or hash noise occurs. Tapping the fascia panel may also produce the effects. If so, this will be due to the voltage stabiliser, which is an on-off thermal switch to control instrument voltage. It is located usually on the back of the instrument panel, often attached to the speedometer. Correction is by attachment of a capacitor and, if still troublesome, chokes in the supply wires.

Switch on the engine and listen for interference on the MW band. Depending on the type of interference, the indications are as follows.

A harsh crackle that drops out abruptly at low engine speed or when the headlights are switched on is probably due to a voltage regulator.

A whine varying with engine speed is due to the dynamo or

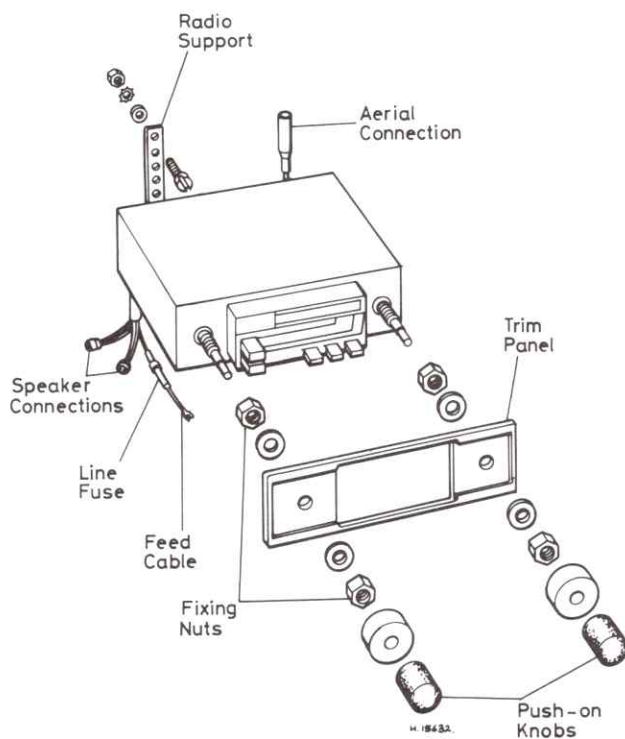


Fig. 12.24 Mounting component details for radio/cassette unit (Sec 29)

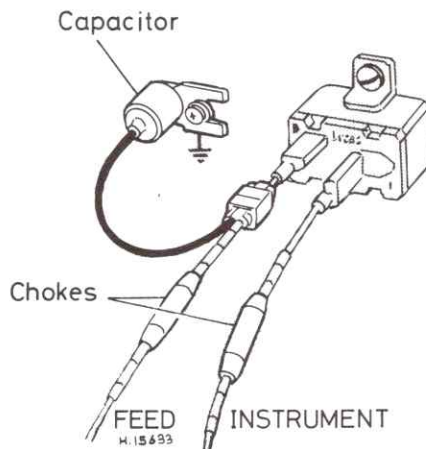


Fig. 12.25 Voltage stabilizer interference suppression (Sec 29)

alternator. Try temporarily taking off the fan belt – if the noise goes this is confirmation.

Regular ticking or crackle that varies in rate with the engine speed is due to the ignition system. With this trouble in particular and others in general, check to see if the noise is entering the receiver from the wiring or by radiation. To do this, pull out the aerial plug, (preferably shorting out the input socket or connecting a 62 pF capacitor across it). If the noise disappears it is coming in through the aerial and is *radiation noise*. If the noise persists it is reaching the receiver through the wiring and is said to be *line-borne*.

Interference from wipers, washers, heater blowers, turn-indicators, stop lamps, etc is usually taken to the receiver by wiring, and simple treatment using capacitors and possibly chokes will solve the problem. Switch on each one in turn (wet the screen first for running wipers!) and listen for possible interference with the aerial plug in place and again when removed.

Electric petrol pumps are now finding application again and give rise to an irregular clicking, often giving a burst of clicks when the ignition is on but the engine has not yet been started. It is also possible to receive whining or crackling from the pump.

Note that if most of the vehicle accessories are found to be creating interference all together, the probability is that poor aerial earthing is to blame.

### Component terminal markings

Throughout the following sub-sections reference will be found to various terminal markings. These will vary depending on the manufacturer of the relevant component. If terminal markings differ from those mentioned, reference should be made to the following table, where the most commonly encountered variations are listed.

Alternator	Alternator terminal (thick lead)	Exciting winding terminal
DIN/Bosch	B +	DF
Delco Remy	+	EXC
Ducellier	+	EXC
Ford (US)	+	DF
Lucas	+	F
Marelli	+B	F

Ignition coil	Ignition switch terminal	Contact breaker terminal
DIN/Bosch	15	1
Delco Remy	+	–
Ducellier	BAT	RUP
Ford (US)	B/+	CB/–
Lucas	SW/+	–
Marelli	BAT/+B	D

Voltage regulator	Voltage input terminal	Exciting winding terminal
DIN/Bosch	B +/D +	DF
Delco Remy	BAT/+	EXC
Ducellier	BOB/BAT	EXC
Ford (US)	BAT	DF
Lucas	+/A	F
Marelli		F

### Suppression methods – ignition

Suppressed HT cables are supplied as original equipment by manufacturers and will meet regulations as far as interference to neighbouring equipment is concerned. It is illegal to remove such suppression unless an alternative is provided, and this may take the form of resistive spark plug caps in conjunction with plain copper HT cable. For VHF purposes, these and 'in-line' resistors may not be effective, and resistive HT cable is preferred. Check that suppressed cables are actually fitted by observing cable identity lettering, or measuring with an ohmmeter – the value of each plug lead should be 5000 to 10 000 ohms.

A 1 microfarad capacitor connected from the LT supply side of the ignition coil to a good nearby earth point will complete basic ignition interference treatment. *NEVER fit a capacitor to the coil terminal to the contact breaker – the result would be burnt out points in a short time.*

If ignition noise persists despite the treatment above, the following sequence should be followed:

- Check the earthing of the ignition coil; remove paint from fixing clamp.
- If this does not work, lift the bonnet. Should there be no change in interference level, this may indicate that the bonnet is not electrically connected to the car body. Use a proprietary braided strap across a bonnet hinge ensuring a first class electrical connection. If, however, lifting the bonnet increases the interference, then fit resistive HT cables of a higher ohms-per-metre value.
- If all these measures fail, it is probable that re-radiation from metallic components is taking place. Using a braided strap between metallic points, go round the vehicle systematically – try the following: engine to body, exhaust system to body, front suspension to engine and to body, steering column to body (especially French and Italian cars), gear lever to engine and to body (again especially French and Italian cars), Bowden cable to body, metal parcel shelf to body. When an offending component is located it should be bonded with the strap permanently.
- As a next step, the fitting of distributor suppressors to each lead at the distributor end may help.
- Beyond this point is involved the possible screening of the distributor and fitting resistive spark plugs, but such advanced treatment is not usually required for vehicles with entertainment equipment.

Electronic ignition systems have built-in suppression components, but this does not relieve the need for using suppressed HT leads. In some cases it is permitted to connect a capacitor on the low tension supply side of the ignition coil, but not in every case. Makers' instructions should be followed carefully, otherwise damage to the ignition semiconductors may result.

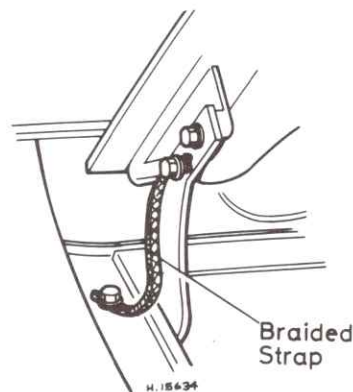


Fig. 12.26 Braided earth strap between bonnet and body (Sec 29)

### Suppression methods – generators

For older vehicles with dynamos a 1 microfarad capacitor from the D (larger) terminal to earth will usually cure dynamo whine. Alternators should be fitted with a 3 microfarad capacitor from the B + main output terminal (thick cable) to earth. Additional suppression may be obtained by the use of a filter in the supply line to the radio receiver.

It is most important that:

- Capacitors are never connected to the field terminals of either a dynamo or alternator.
- Alternators must not be run without connection to the battery.

### Suppression methods – voltage regulators

Voltage regulators used with DC dynamos should be suppressed by connecting a 1 microfarad capacitor from the control box D terminal to earth.

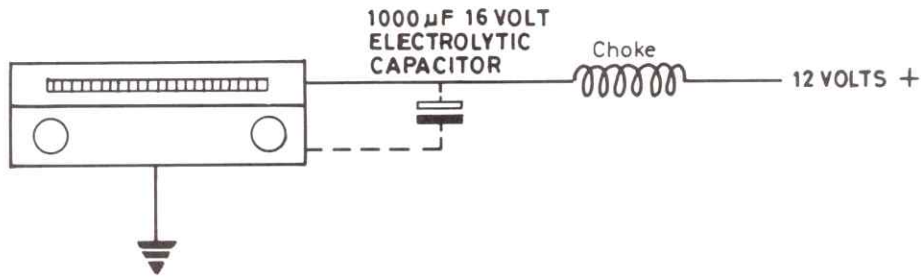


Fig. 12.27 Line-borne interference suppression (Sec 29)

Alternator regulators come in three types:

- (a) *Vibrating contact regulators separate from the alternator. Used extensively on continental vehicles.*
- (b) *Electronic regulators separate from the alternator.*
- (c) *Electronic regulators built-in to the alternator.*

In case (a) interference may be generated on the AM and FM (VHF) bands. For some cars a replacement suppressed regulator is available. Filter boxes may be used with non-suppressed regulators. But if not available, then for AM equipment a 2 microfarad or 3

microfarad capacitor may be mounted at the voltage terminal marked D+ or B+ of the regulator. FM bands may be treated by a feed-through capacitor of 2 or 3 microfarad.

Electronic voltage regulators are not always troublesome, but where necessary, a 1 microfarad capacitor from the regulator + terminal will help.

Integral electronic voltage regulators do not normally generate much interference, but when encountered this is in combination with alternator noise. A 1 microfarad or 2 microfarad capacitor from the warning lamp (IND) terminal to earth for Lucas ACR alternators and Femsa, Delco and Bosch equivalents should cure the problem.

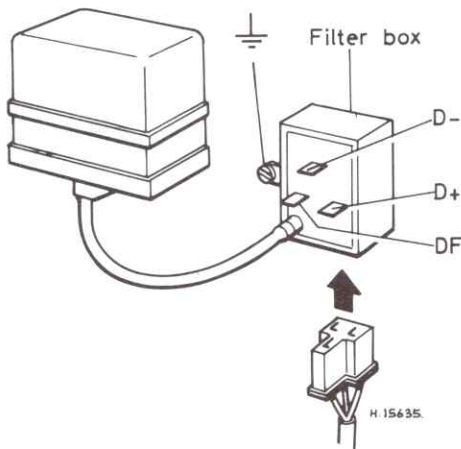


Fig. 12.28 Typical filter box for vibrating contact voltage regulator (alternator equipment) (Sec 29)

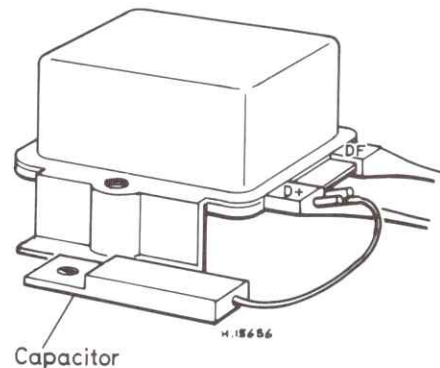


Fig. 12.29 Suppression of AM interference by vibrating contact voltage regulator (alternator equipment) (Sec 29)

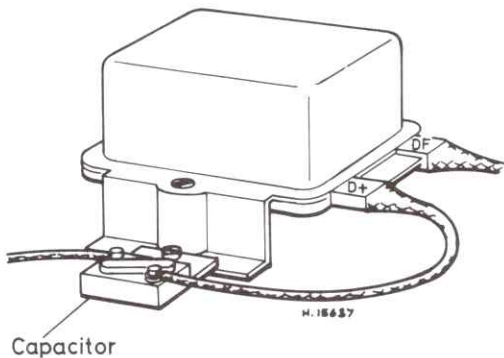


Fig. 12.30 Suppression of FM interference by vibrating contact voltage regulator (alternator equipment) (Sec 29)

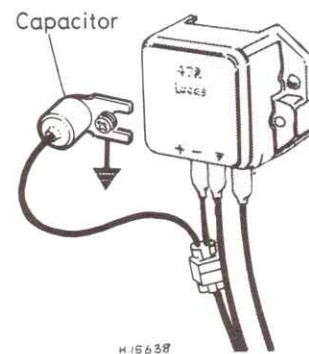


Fig. 12.31 Electronic voltage regulator suppression (Sec 29)

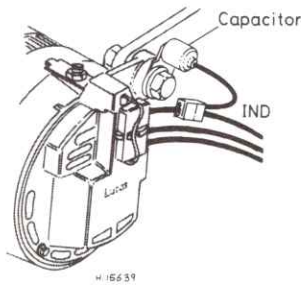


Fig. 12.32 Suppression of interference from electronic voltage regulator when integral with alternator (Sec 29)

#### Suppression methods – other equipment

**Wiper motors** – Connect the wiper body to earth with a bonding strap. For all motors use a 7 ampere choke assembly inserted in the leads to the motor.

**Heater motors** – Fit 7 ampere line chokes in both leads, assisted if necessary by a 1 microfarad capacitor to earth from both leads.

**Electronic tachometer** – The tachometer is a possible source of ignition noise – check by disconnecting at the ignition coil CB terminal. It usually feeds from ignition coil LT pulses at the contact breaker terminal. A 3 ampere line choke should be fitted in the tachometer lead at the coil CB terminal.

**Horn** – A capacitor and choke combination is effective if the horn is directly connected to the 12 volt supply. The use of a relay is an alternative remedy, as this will reduce the length of the interference-carrying leads.

**Electrostatic noise** – Characteristics are erratic crackling at the receiver, with disappearance of symptoms in wet weather. Often shocks may be given when touching bodywork. Part of the problem is

the build-up of static electricity in non-driven wheels and the acquisition of charge on the body shell. It is possible to fit spring-loaded contacts at the wheels to give good conduction between the rotary wheel parts and the vehicle frame. Changing a tyre sometimes helps – because of tyres' varying resistances. In difficult cases a trailing flex which touches the ground will cure the problem. If this is not acceptable it is worth trying conductive paint on the tyre walls.

**Fuel pump** – Suppression requires a 1 microfarad capacitor between the supply wire to the pump and a nearby earth point. If this is insufficient a 7 ampere line choke connected in the supply wire near the pump is required.

**Fluorescent tubes** – Vehicles used for camping/caravanning frequently have fluorescent tube lighting. These tubes require a relatively high voltage for operation and this is provided by an inverter (a form of oscillator) which steps up the vehicle supply voltage. This can give rise to serious interference to radio reception, and the tubes themselves can contribute to this interference by the pulsating nature of the lamp discharge. In such situations it is important to mount the aerial as far away from a fluorescent tube as possible. The interference problem may be alleviated by screening the tube with fine wire turns spaced an inch (25 mm) apart and earthed to the chassis. Suitable chokes should be fitted in both supply wires close to the inverter.

#### Radio/cassette case breakthrough

Magnetic radiation from dashboard wiring may be sufficiently intense to break through the metal case of the radio/cassette player. Often this is due to a particular cable routed too close and shows up as ignition interference on AM and cassette play and/or alternator whine on cassette play.

The first point to check is that the clips and/or screws are fixing all parts of the radio/cassette case together properly. Assuming good earthing of the case, see if it is possible to re-route the offending cable – the chances of this are not good, however, in most cars.

Next release the radio/cassette player and locate it in different positions with temporary leads. If a point of low interference is found, then if possible fix the equipment in that area. This also confirms that local radiation is causing the trouble. If re-location is not feasible, fit the radio/cassette player back in the original position.

Alternator interference on cassette play is now caused by radiation from the main charging cable which goes from the battery to the output terminal of the alternator, usually via the + terminal of the starter motor relay. In some vehicles this cable is routed under the

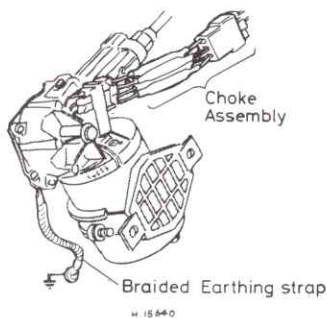


Fig. 12.33 Wiper motor suppression (Sec 29)

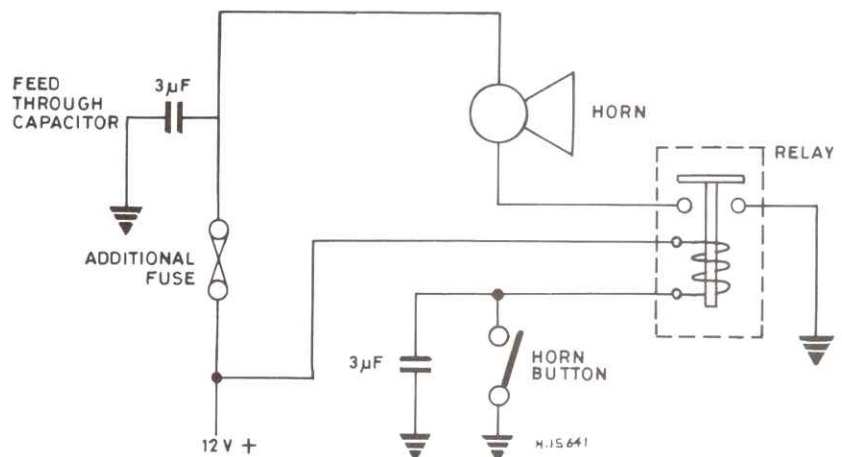


Fig. 12.34 Use of relay to reduce horn interference (Sec 29)

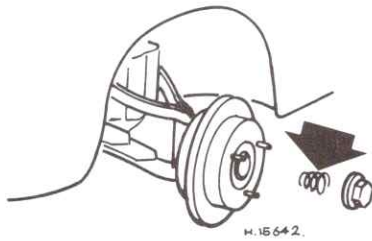


Fig. 12.35 Use of spring contacts at wheels (Sec 29)

dashboard, so the solution is to provide a direct cable route. Detach the original cable from the alternator output terminal and make up a new cable of at least 6 mm<sup>2</sup> cross-sectional area to go from alternator to battery with the shortest possible route. *Remember – do not run the engine with the alternator disconnected from the battery.*

Ignition breakthrough on AM and/or cassette play can be a difficult problem. It is worth wrapping earthed foil round the offending cable run near the equipment, or making up a deflector plate well screwed down to a good earth. Another possibility is the use of a suitable relay to switch on the ignition coil. The relay should be mounted close to the ignition coil; with this arrangement the ignition coil primary current is not taken into the dashboard area and does not flow through the ignition switch. A suitable diode should be used since it is possible that at ignition switch-off the output from the warning lamp alternator terminal could hold the relay on.

#### Connectors for suppression components

Capacitors are usually supplied with tags on the end of the lead, while the capacitor body has a flange with a slot or hole to fit under a nut or screw with washer.

Connections to feed wires are best achieved by self-stripping connectors. These connectors employ a blade which, when squeezed down by pliers, cuts through cable insulation and makes connection to the copper conductors beneath.

Chokes sometimes come with bullet snap-in connectors fitted to the wires, and also with just bare copper wire. With connectors, suitable female cable connectors may be purchased from an auto-accessory shop together with any extra connectors required for the cable ends after being cut for the choke insertion. For chokes with bare wires, similar connectors may be employed together with insulation sleeving as required.

#### VHF/FM broadcasts

Reception of VHF/FM in an automobile is more prone to problems than the medium and long wavebands. Medium/long wave transmitters are capable of covering considerable distances, but VHF transmitters are restricted to line of sight, meaning ranges of 10 to 50 miles, depending upon the terrain, the effects of buildings and the transmitter power.

Because of the limited range it is necessary to retune on a long journey, and it may be better for those habitually travelling long distances or living in areas of poor provision of transmitters to use an AM radio working on medium/long wavebands.

When conditions are poor, interference can arise, and some of the suppression devices described previously fall off in performance at very high frequencies unless specifically designed for the VHF band. Available suppression devices include reactive HT cable, resistive distributor caps, screened plug caps, screened leads and resistive spark plugs.

For VHF/FM receiver installation the following points should be particularly noted:

- Earthing of the receiver chassis and the aerial mounting is important. Use a separate earthing wire at the radio, and scrape paint away at the aerial mounting.

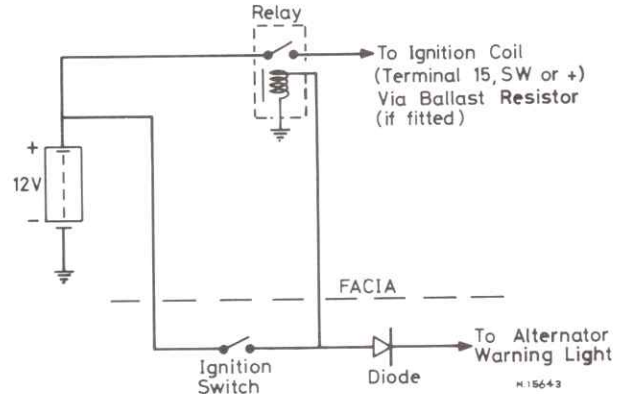


Fig. 12.36 Use of ignition coil relay to suppress case breakthrough (Sec 29)

- If possible, use a good quality roof aerial to obtain maximum height and distance from interference generating devices on the vehicle.
- Use of a high quality aerial downlead is important, since losses in cheap cable can be significant.
- The polarisation of FM transmissions may be horizontal, vertical, circular or slanted. Because of this the optimum mounting angle is at 45° to the vehicle roof.

#### Citizens' Band radio (CB)

In the UK, CB transmitter/receivers work within the 27 MHz and 934 MHz bands, using the FM mode. At present interest is concentrated on 27 MHz where the design and manufacture of equipment is less difficult. Maximum transmitted power is 4 watts, and 40 channels spaced 10 kHz apart within the range 27.60125 to 27.99125 MHz are available.

Aerials are the key to effective transmission and reception. Regulations limit the aerial length to 1.65 metres including the loading coil and any associated circuitry, so tuning the aerial is necessary to obtain optimum results. The choice of a CB aerial is dependent on whether it is to be permanently installed or removable, and the performance will hinge on correct tuning and the location point on the vehicle. Common practice is to clip the aerial to the roof gutter or to employ wing mounting where the aerial can be rapidly unscrewed. An alternative is to use the boot rim to render the aerial theftproof, but a popular solution is to use the 'magmount' – a type of mounting having a strong magnetic base clamping to the vehicle at any point, usually the roof.

Aerial location determines the signal distribution for both transmission and reception, but it is wise to choose a point away from the engine compartment to minimise interference from vehicle electrical equipment.

The aerial is subject to considerable wind and acceleration forces. Cheaper units will whip backwards and forwards and in so doing will alter the relationship with the metal surface of the vehicle with which it forms a ground plane aerial system. The radiation pattern will change correspondingly, giving rise to break-up of both incoming and outgoing signals.

Interference problems on the vehicle carrying CB equipment fall into two categories:

- Interference to nearby TV and radio receivers when transmitting.
- Interference to CB set reception due to electrical equipment on the vehicle.

Problems of break-through to TV and radio are not frequent, but can be difficult to solve. Mostly trouble is not detected or reported because the vehicle is moving and the symptoms rapidly disappear at the TV/radio receiver, but when the CB set is used as a base station any trouble with nearby receivers will soon result in a complaint.

It must not be assumed by the CB operator that his equipment is faultless, for much depends upon the design. Harmonics (that is, multiples) of 27 MHz may be transmitted unknowingly and these can fall into other user's bands. Where trouble of this nature occurs, low pass filters in the aerial or supply leads can help, and should be fitted in base station aerials as a matter of course. In stubborn cases it may be necessary to call for assistance from the licensing authority, or, if possible, to have the equipment checked by the manufacturers.

Interference received on the CB set from the vehicle equipment is, fortunately, not usually a severe problem. The precautions outlined previously for radio/cassette units apply, but there are some extra points worth noting.

It is common practice to use a slide-mount on CB equipment enabling the set to be easily removed for use as a base station, for example. Care must be taken that the slide mount fittings are properly earthed and that first class connection occurs between the set and slide-mount.

Vehicle manufacturers in the UK are required to provide suppression of electrical equipment to cover 40 to 250 MHz to protect

TV and VHF radio bands. Such suppression appears to be adequately effective at 27 MHz, but suppression of individual items such as alternators/dynamos, clocks, stabilisers, flashers, wiper motors, etc, may still be necessary. The suppression capacitors and chokes available from auto-electrical suppliers for entertainment receivers will usually give the required results with CB equipment.

### Other vehicle radio transmitters

Besides CB radio already mentioned, a considerable increase in the use of transceivers (ie combined transmitter and receiver units) has taken place in the last decade. Previously this type of equipment was fitted mainly to military, fire, ambulance and police vehicles, but a large business radio and radio telephone usage has developed.

Generally the suppression techniques described previously will suffice, with only a few difficult cases arising. Suppression is carried out to satisfy the 'receive mode', but care must be taken to use heavy duty chokes in the equipment supply cables since the loading on 'transmit' is relatively high.

## 30 Fault diagnosis – electrical system

Symptom	Reason(s)
No voltage at starter motor	Battery discharged Battery defective internally Battery terminals loose or earth lead not securely attached to body Loose or broken connections in starter motor circuit Starter motor switch or solenoid faulty
Voltage at starter motor – faulty motor	Starter brushes badly worn, sticking, or brush wires loose Commutator dirty, worn or burnt Starter motor armature faulty Field coils earthed
Starter motor noisy or rough in engagement	Pinion or flywheel gear teeth broken or worn Starter motor retaining bolts loose
Alternator not charging*	Drivebelt loose and slipping, or broken Bushes worn, sticking, broken or dirty Brush springs weak or broken

*\*If all appears to be well but the alternator is still not charging, take the car to an automobile electrician for checking of the alternator*

Battery will not hold charge for more than a few days	Battery defective internally Electrolyte level too low or electrolyte too weak due to leakage Plate separators no longer fully effective Battery plates severely sulphated Drivebelt slipping Battery terminal connections loose or corroded Alternator not charging properly Short in lighting circuit causing continual battery drain
Ignition light fails to go out, battery runs flat in a few days	Drivebelt loose and slipping, or broken Alternator faulty

### Failure of individual electrical equipment to function correctly is dealt with alphabetically below

Fuel gauge gives no reading	Fuel tank empty Electric cable between tank sender unit and gauge earthed or loose Fuel gauge case not earthed Fuel gauge supply cable interrupted Fuel gauge unit broken
Fuel gauge registers full all the time	Electric cable between tank unit and gauge broken or disconnected
Horn operates all the time	Horn push either earthed or stuck down Horn cable to horn push earthed

Symptom	Reason(s)
Horn fails to operate	Blown fuse Cable or cable connection loose, broken or disconnected Horn has an internal fault
Horn emits intermittent or unsatisfactory noise	Cable connections loose Horn incorrectly adjusted
Lights do not come on	If engine not running, battery discharged Light bulb filament burnt out or bulbs broken Wire connections loose, disconnected or broken Light switch shorting or otherwise faulty
Lights come on but fade	If engine not running, battery discharged
Lights give very poor illumination	Lamp glasses dirty Reflector tarnished or dirty Lamps badly out of adjustment Incorrect bulb with too low wattage fitted Existing bulbs old and badly discoloured Electrical wiring too thin not allowing full current to pass
Lights work erratically, flashing on and off, especially over bumps	Battery terminals or earth connections loose Lights not earthing properly Contacts in light switch faulty
Wiper motor fails to work	Blown fuse Brushes badly worn Wire connections loose, disconnected or broken Armature worn or faulty Field coils faulty
Wiper motor works very slowly and takes excessive current	Commutator dirty, greasy or burnt Drive to spindles bent or unlubricated Drive spindle binding or damaged Armature bearings dry or misaligned Armature body worn or faulty
Wiper motor works slowly and takes little current	Brushes badly worn Commutator dirty, greasy or burnt Armature badly worn or faulty
Wiper motor works but wiper blades remain static	Linkage disengaged or faulty Drive spindle damaged or worn Wiper motor gearbox parts badly worn

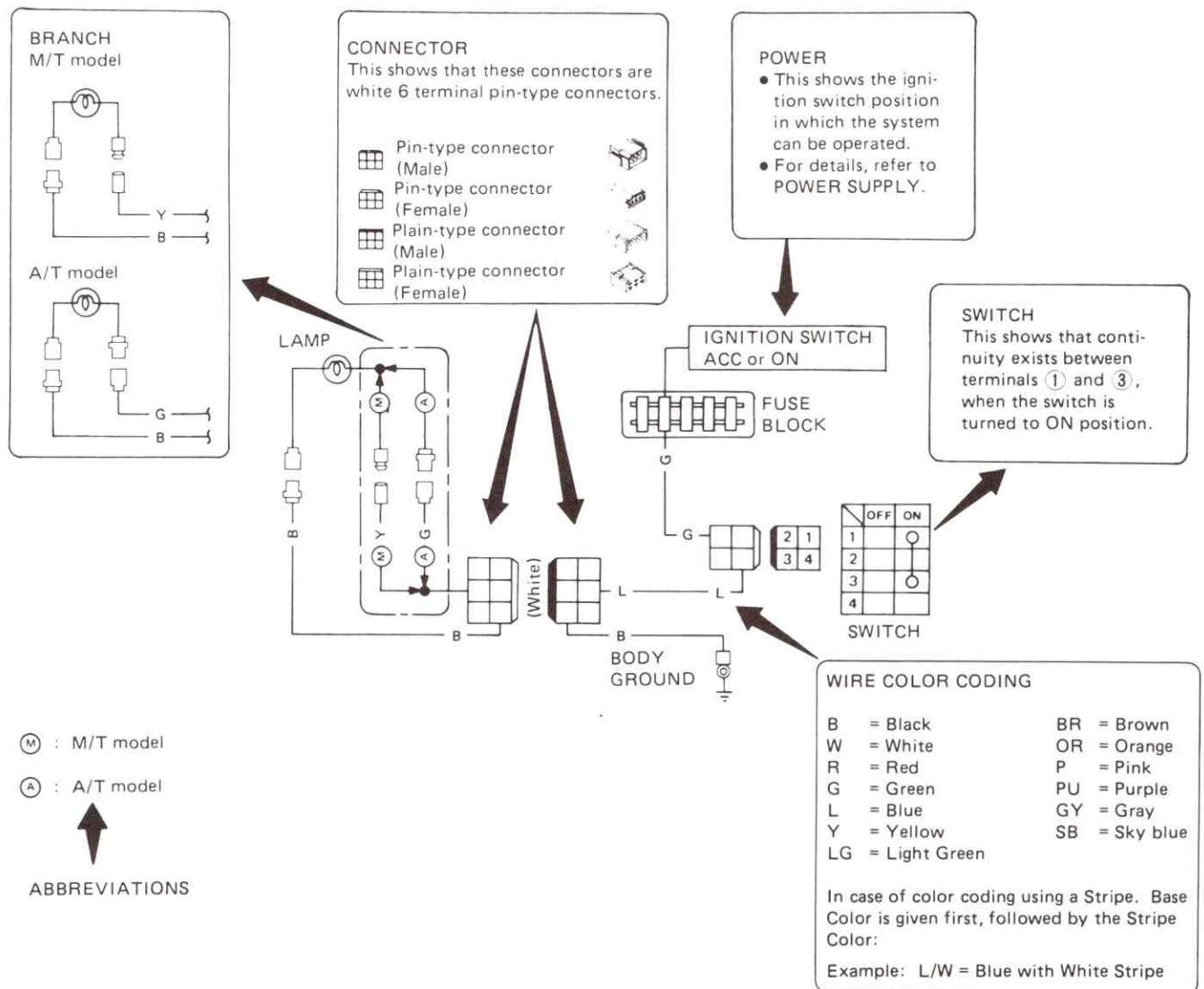


Fig. 12.37 How to use the wiring diagrams

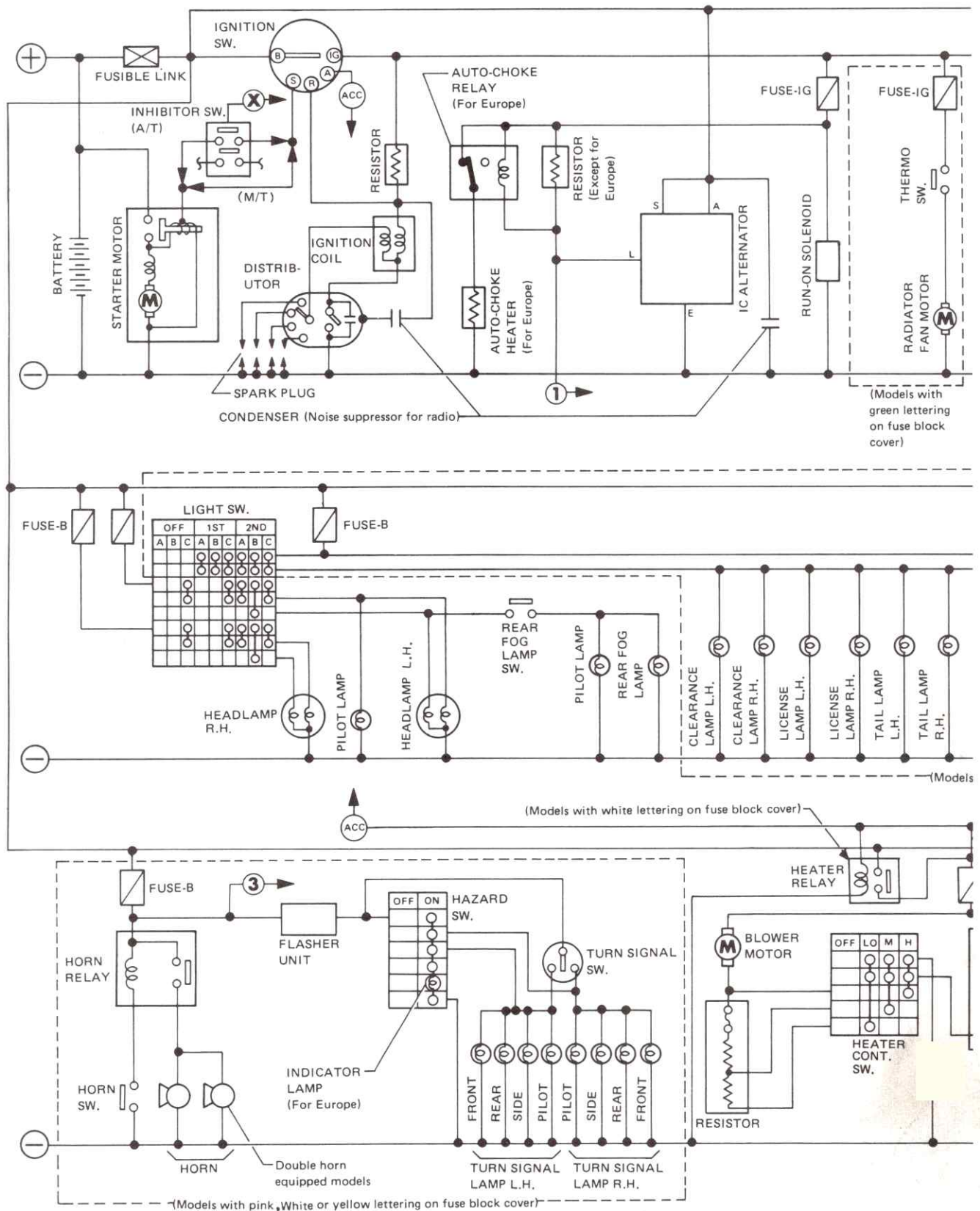


Fig. 12.38 Schematic wiring diagram (all models)

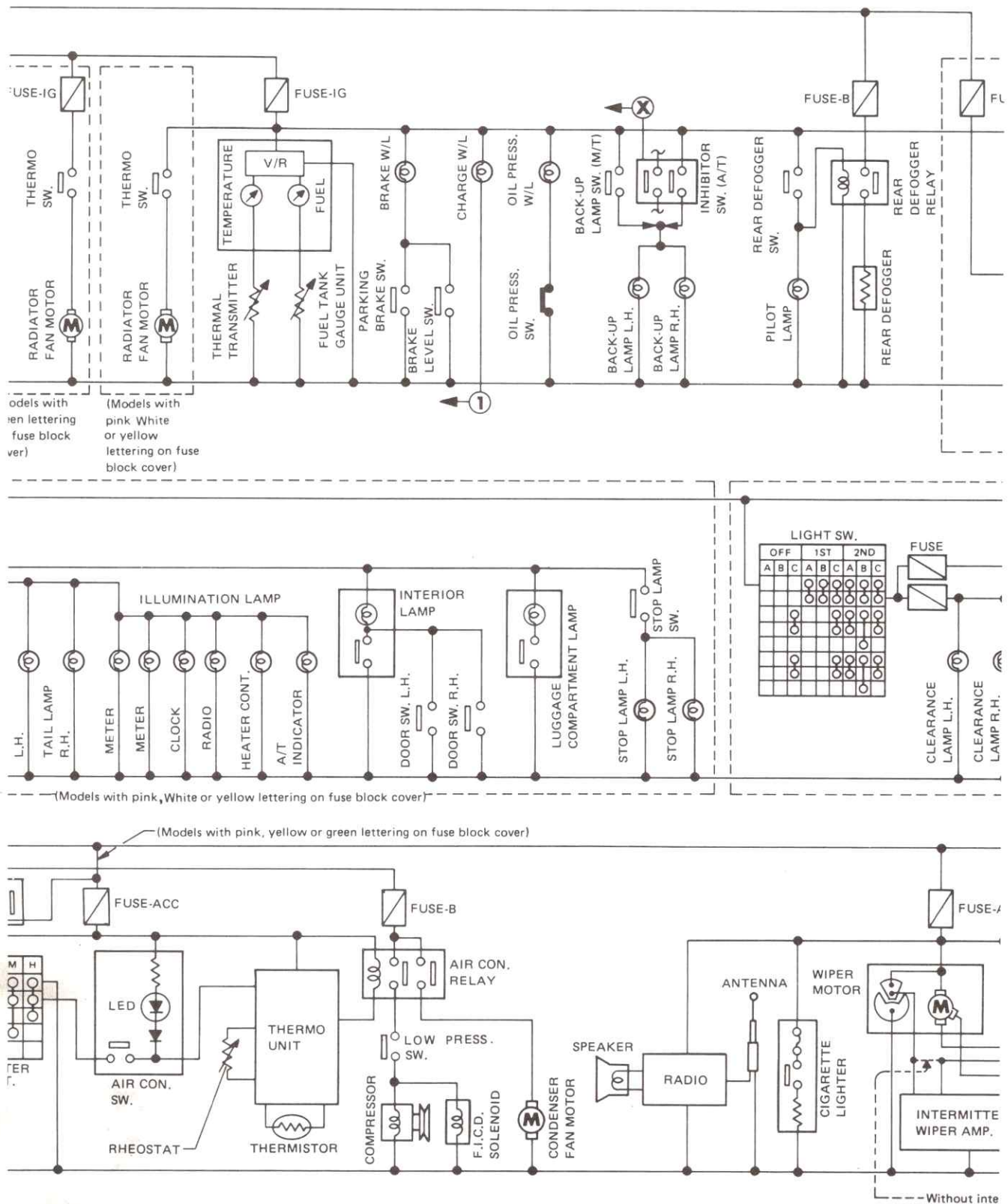


Fig. 12.38 Schematic wiring diagram (all models) (continued)

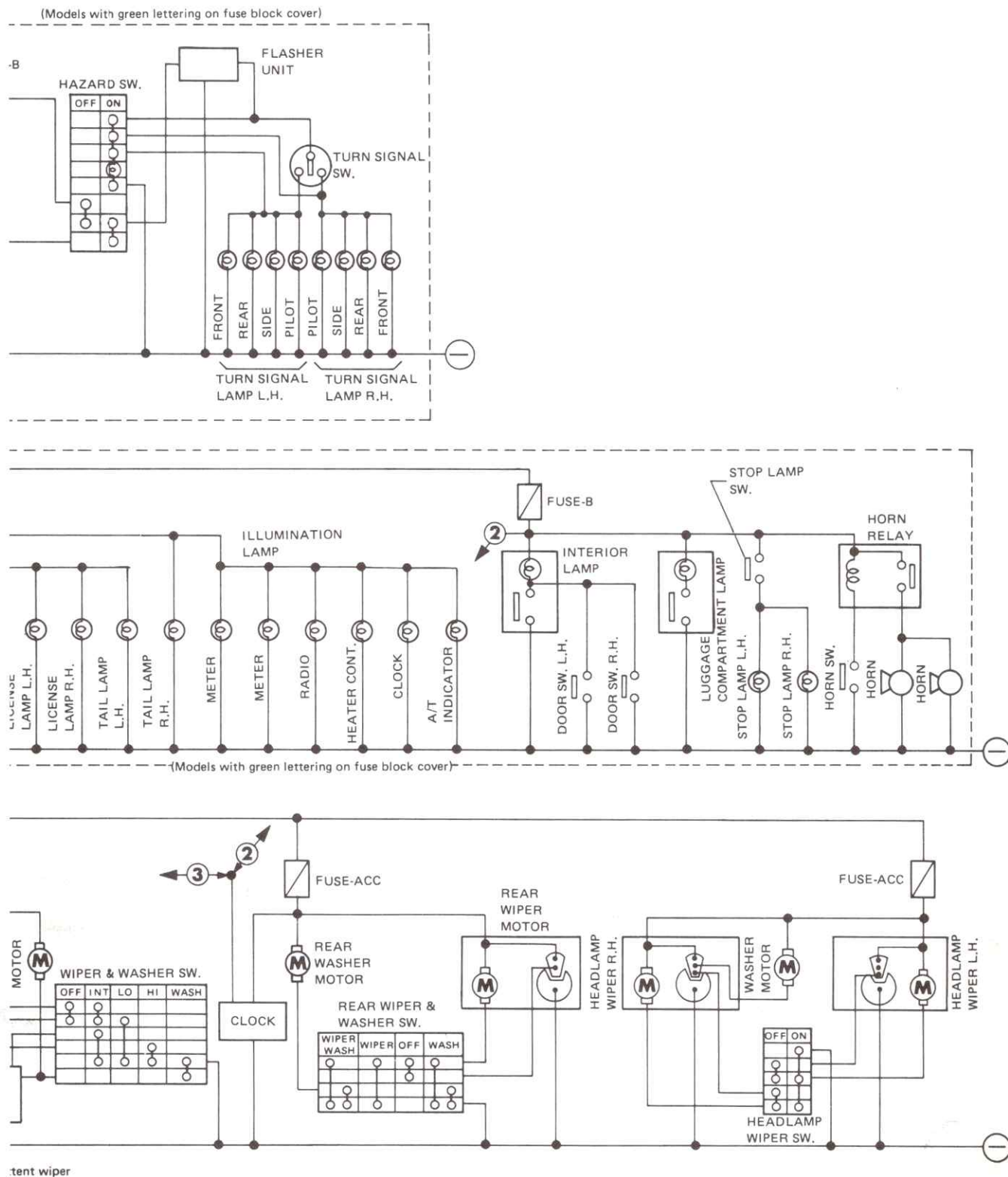


Fig. 12.38 Schematic wiring diagram (all models) (continued)

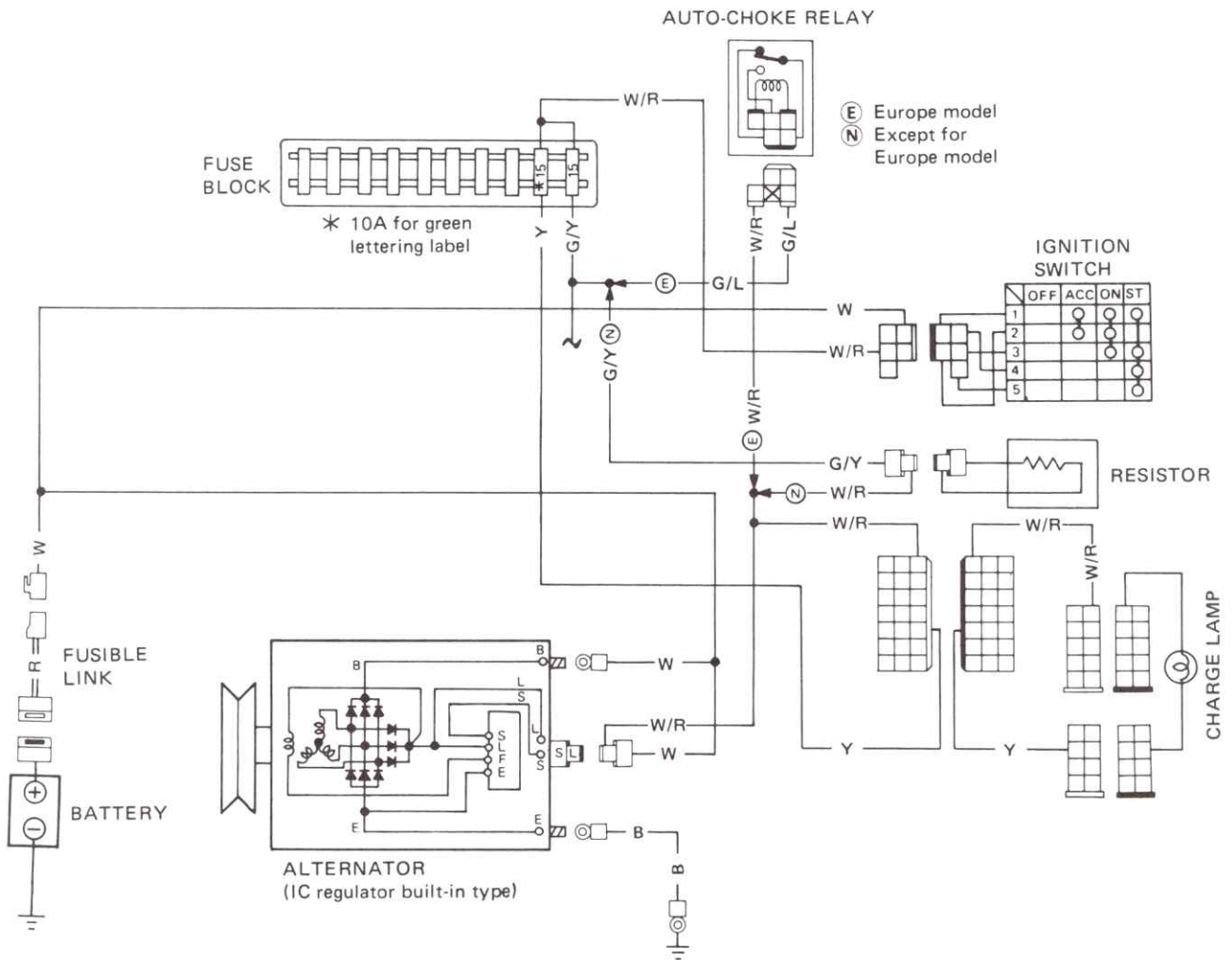
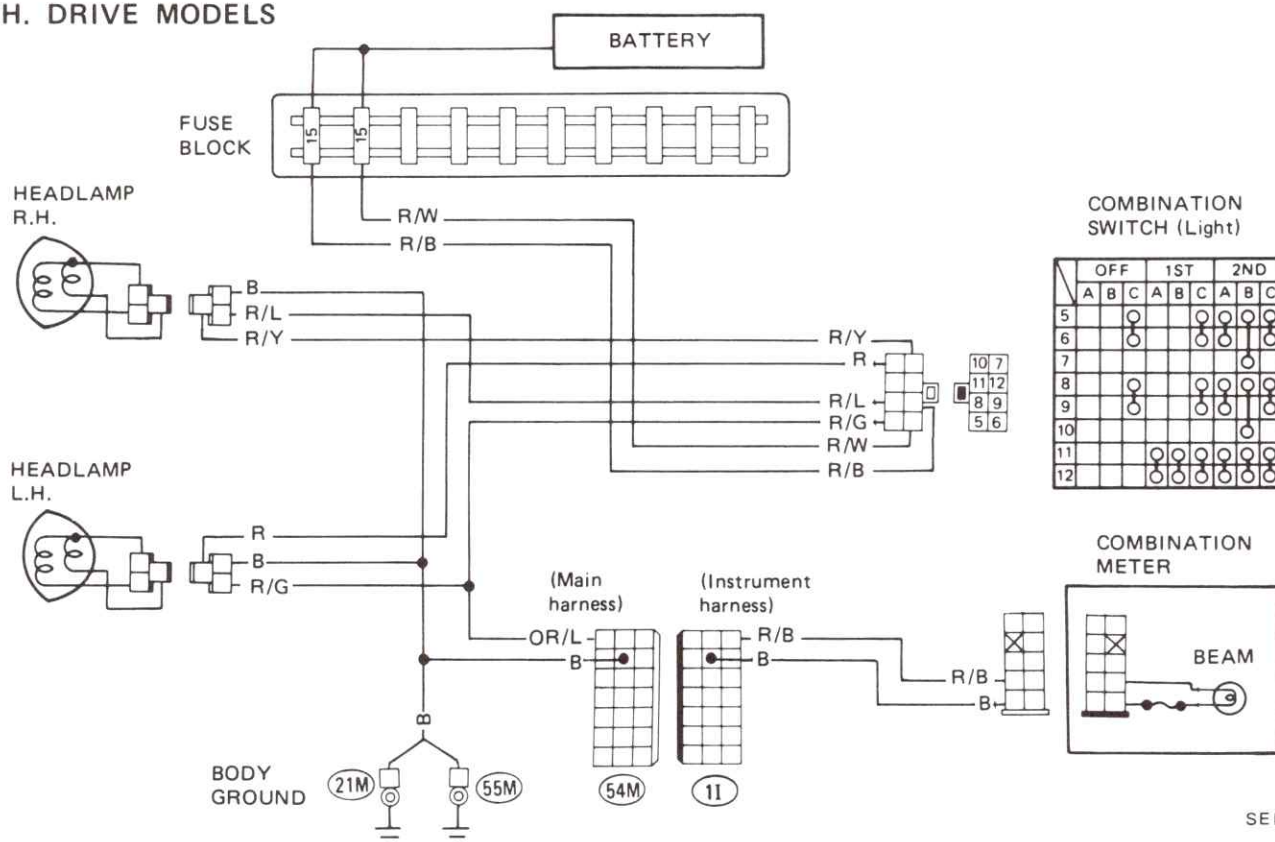


Fig. 12.39 Wiring diagram, charging circuit (1983 to 1984)

## L.H. DRIVE MODELS



SEL990C

## R.H. DRIVE MODELS

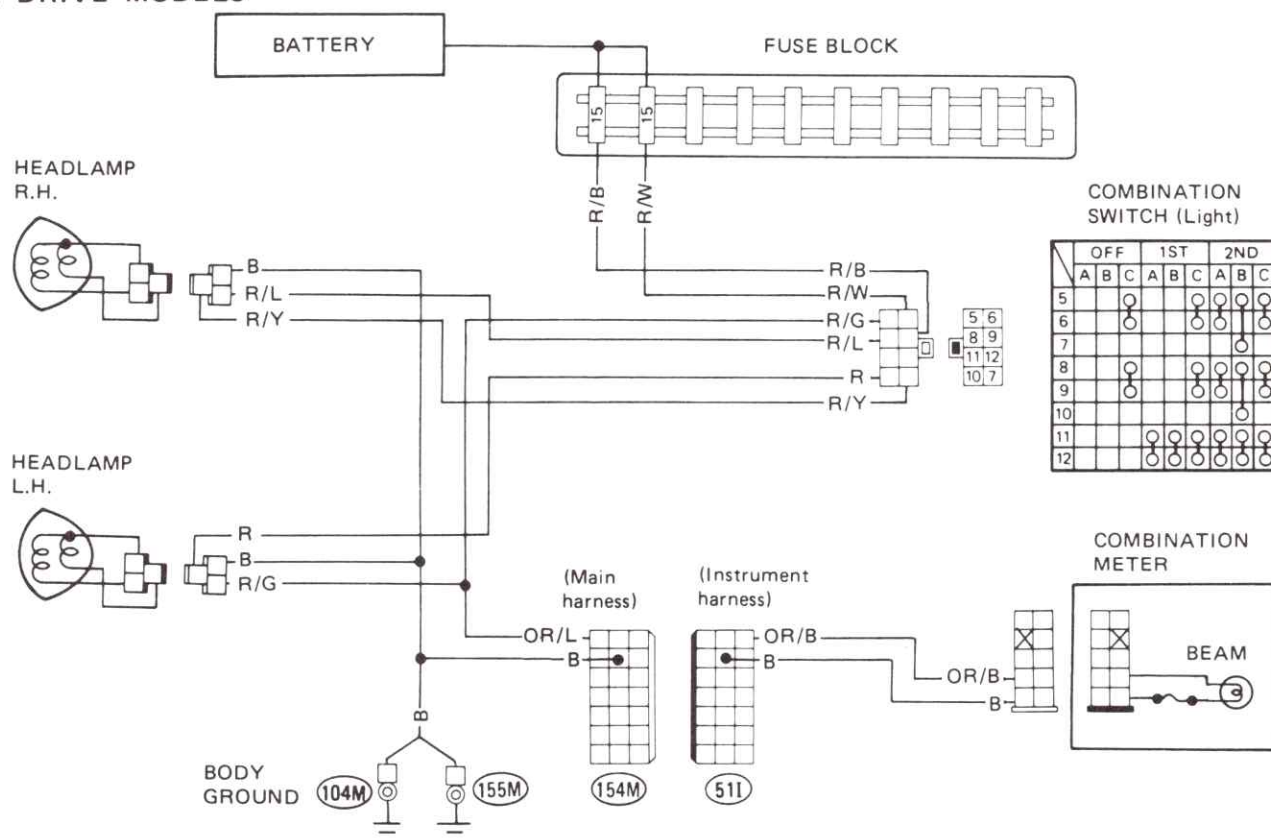


Fig. 12.40 Wiring diagram, headlamp circuit (1983 to 1984)

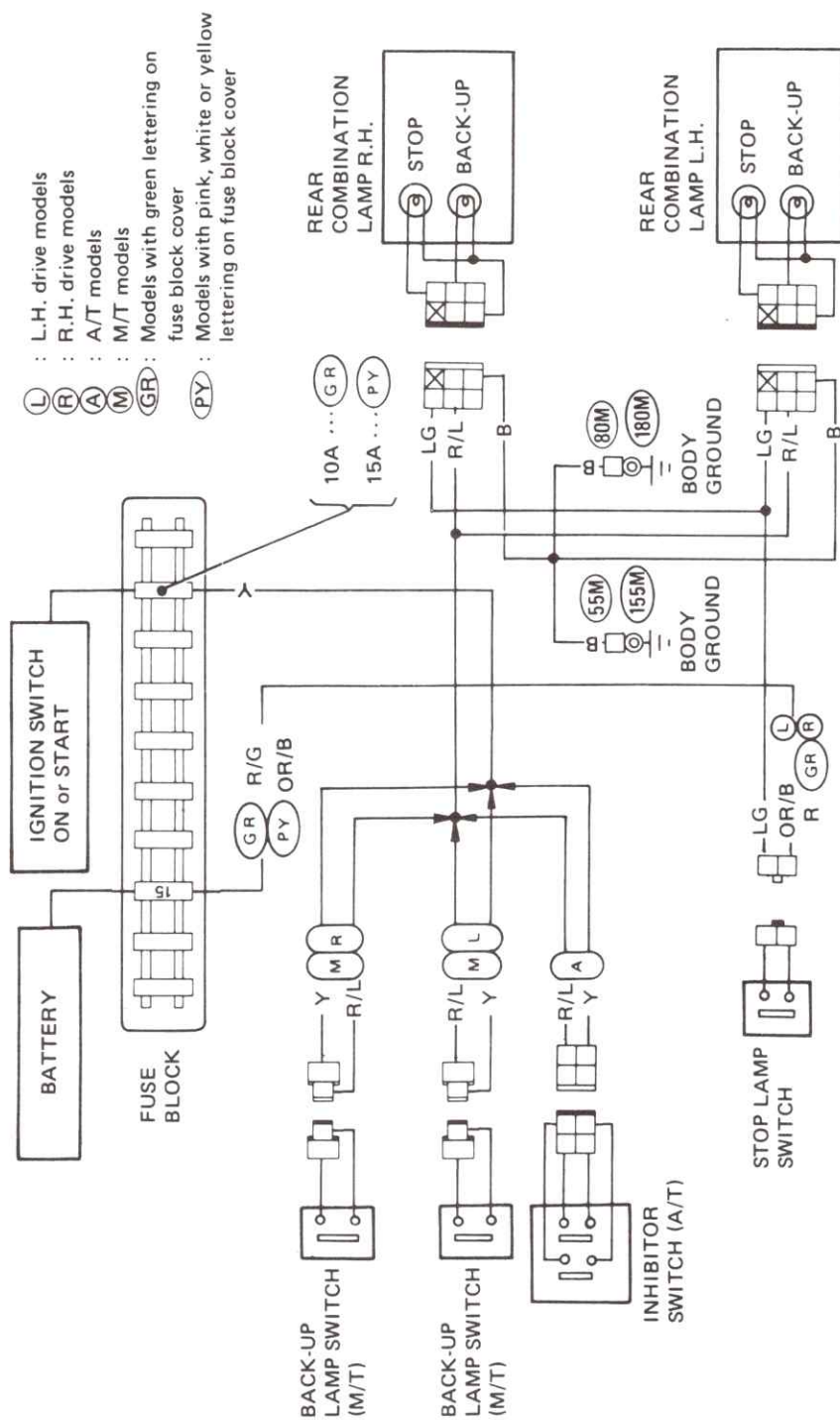
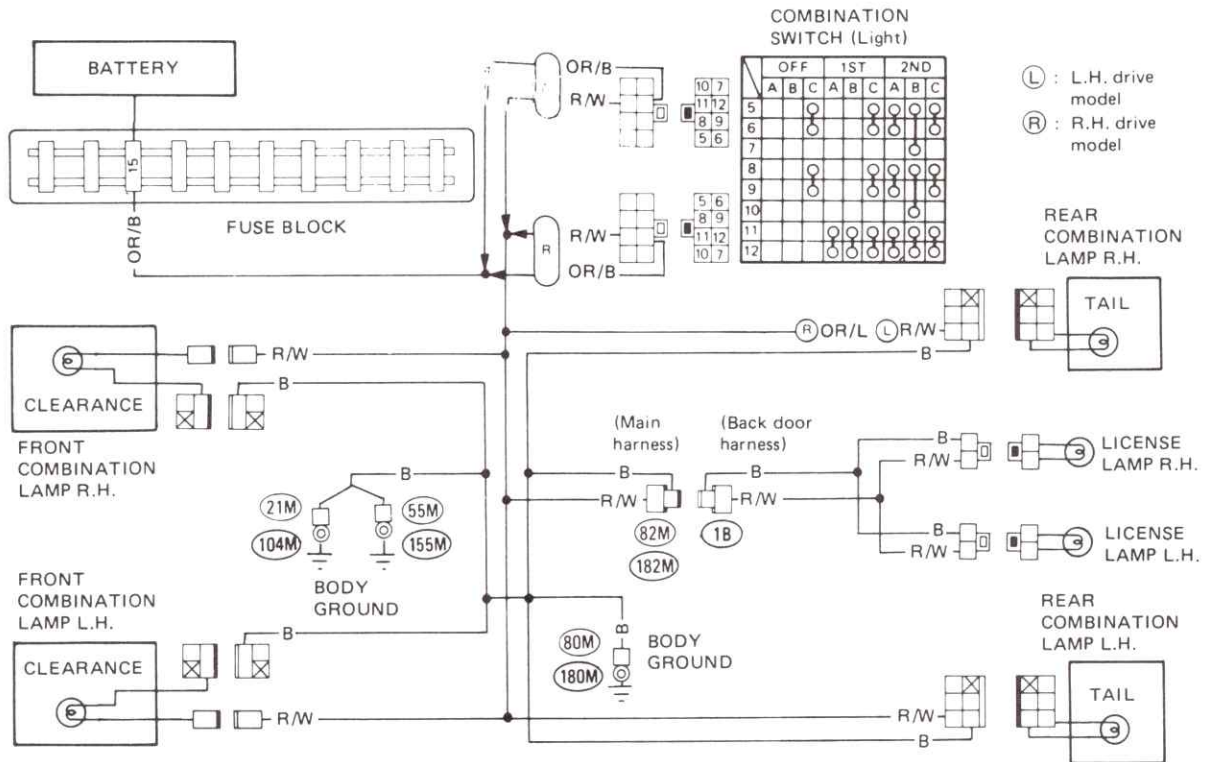


Fig. 12.41 Wiring diagram, reversing light and stoplight circuit (1983 to 1984)

# MODELS WITH PINK, WHITE OR YELLOW LETTERING ON FUSE BLOCK COVER



# MODELS WITH GREEN LETTERING ON FUSE BLOCK COVER

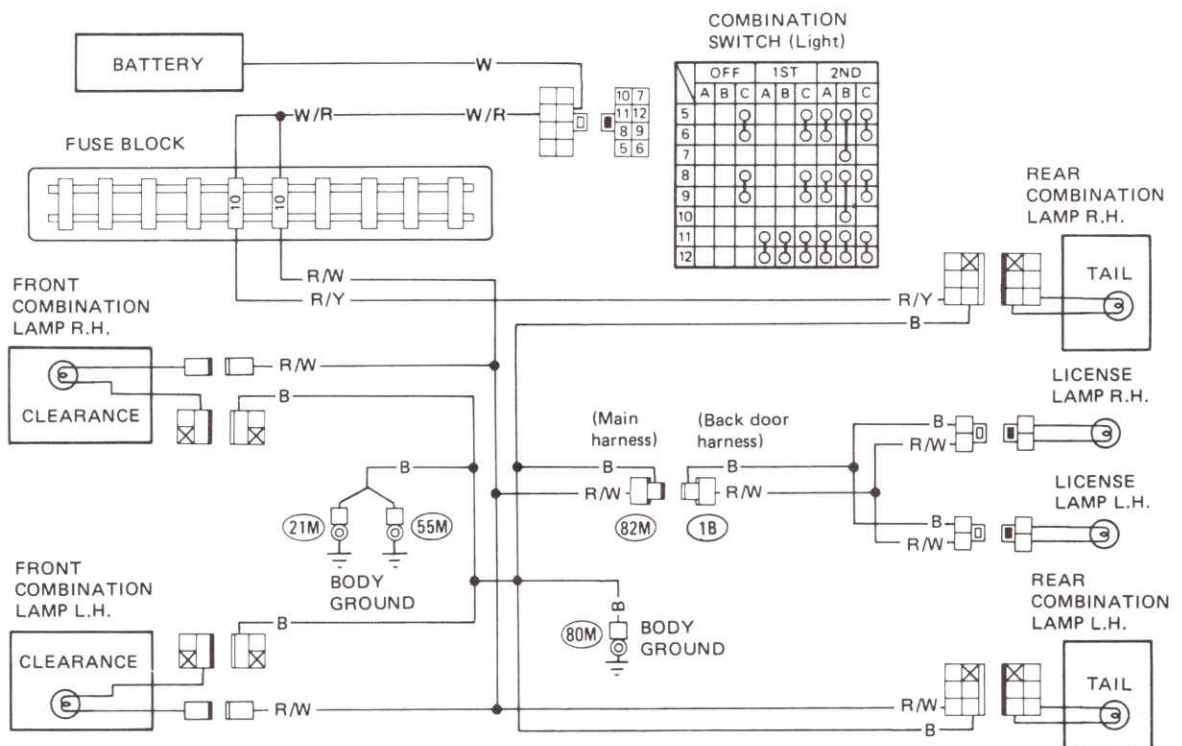


Fig. 12.42 Wiring diagram, sidelight and number plate light circuits (1983 to 1984)





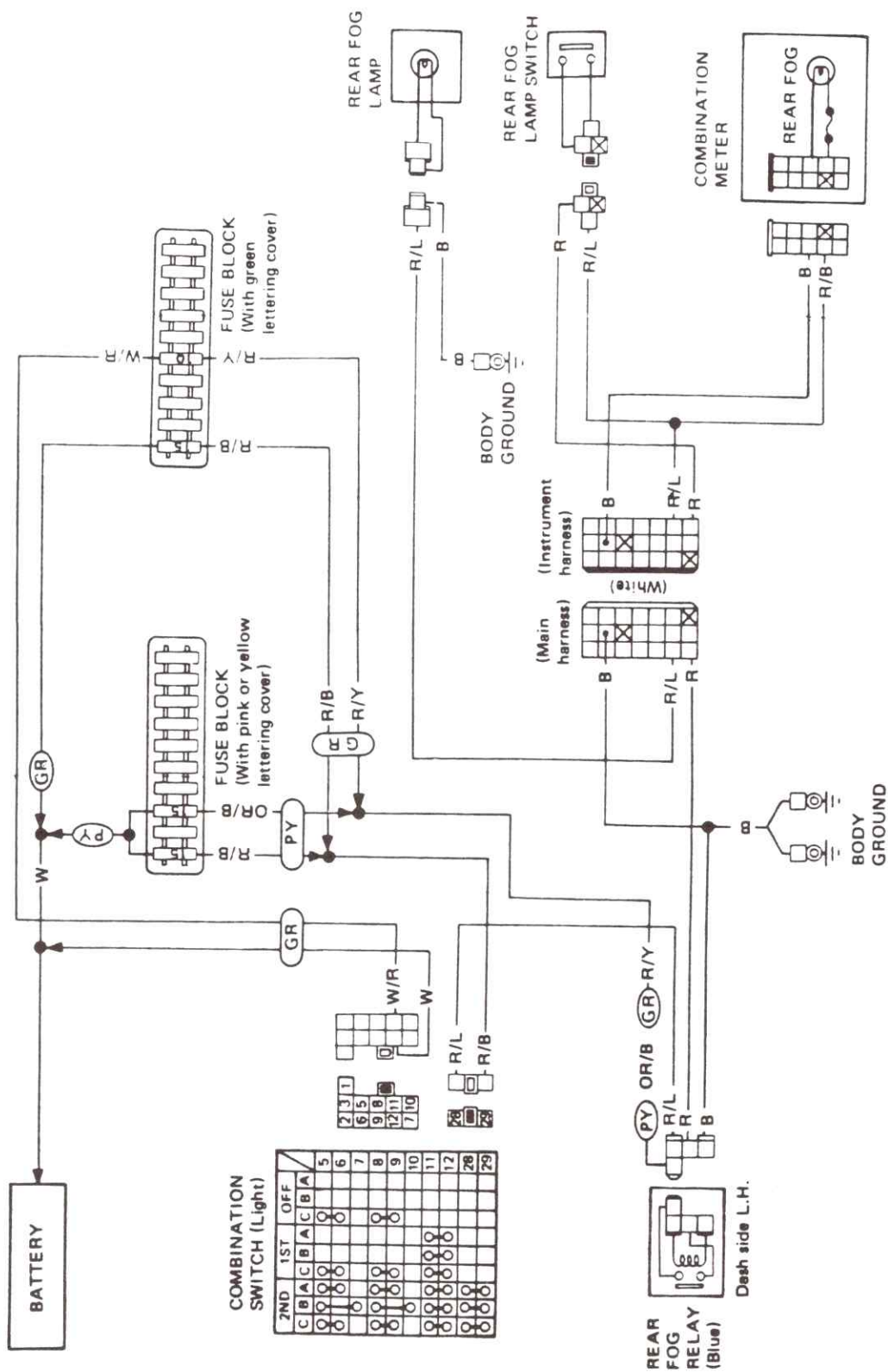


Fig. 12.45 Wiring diagram, rear foglamp circuit (1983 to 1984)

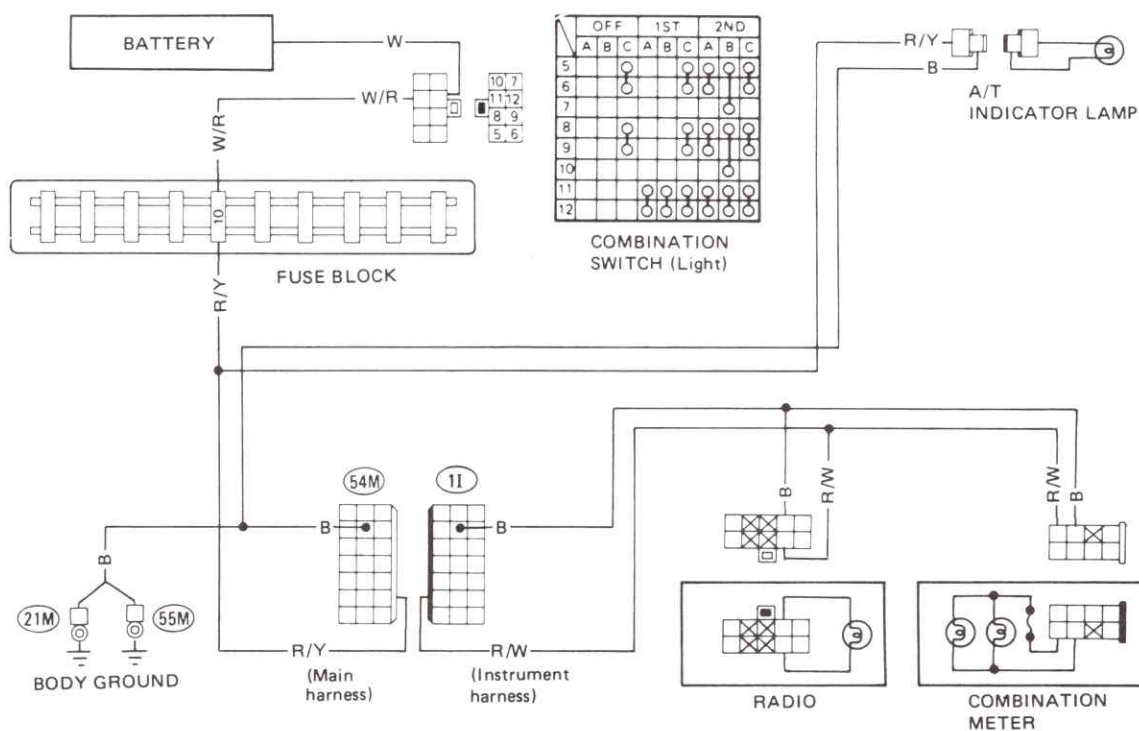


Fig. 12.46 Wiring diagram, instrument illumination circuit (1983 to 1984)

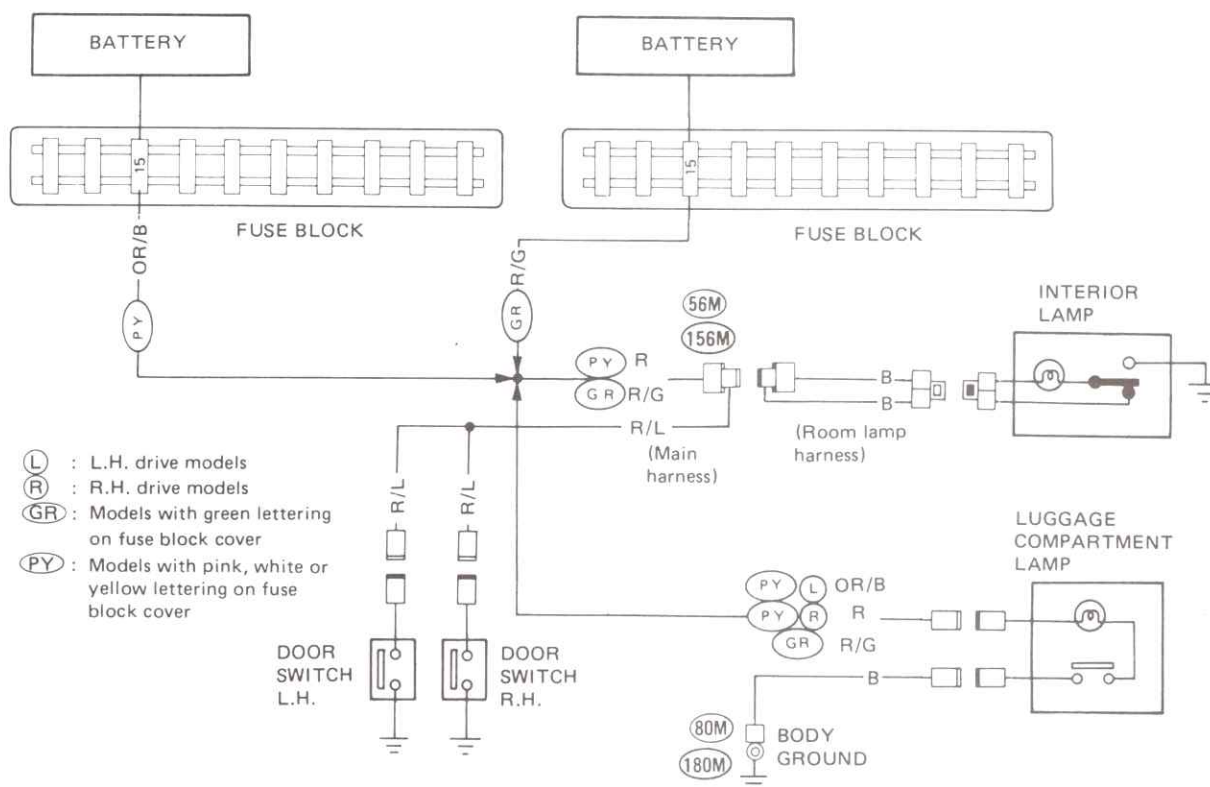


Fig. 12.47 Wiring diagram, interior and luggage compartment lights circuit (1983 to 1984)

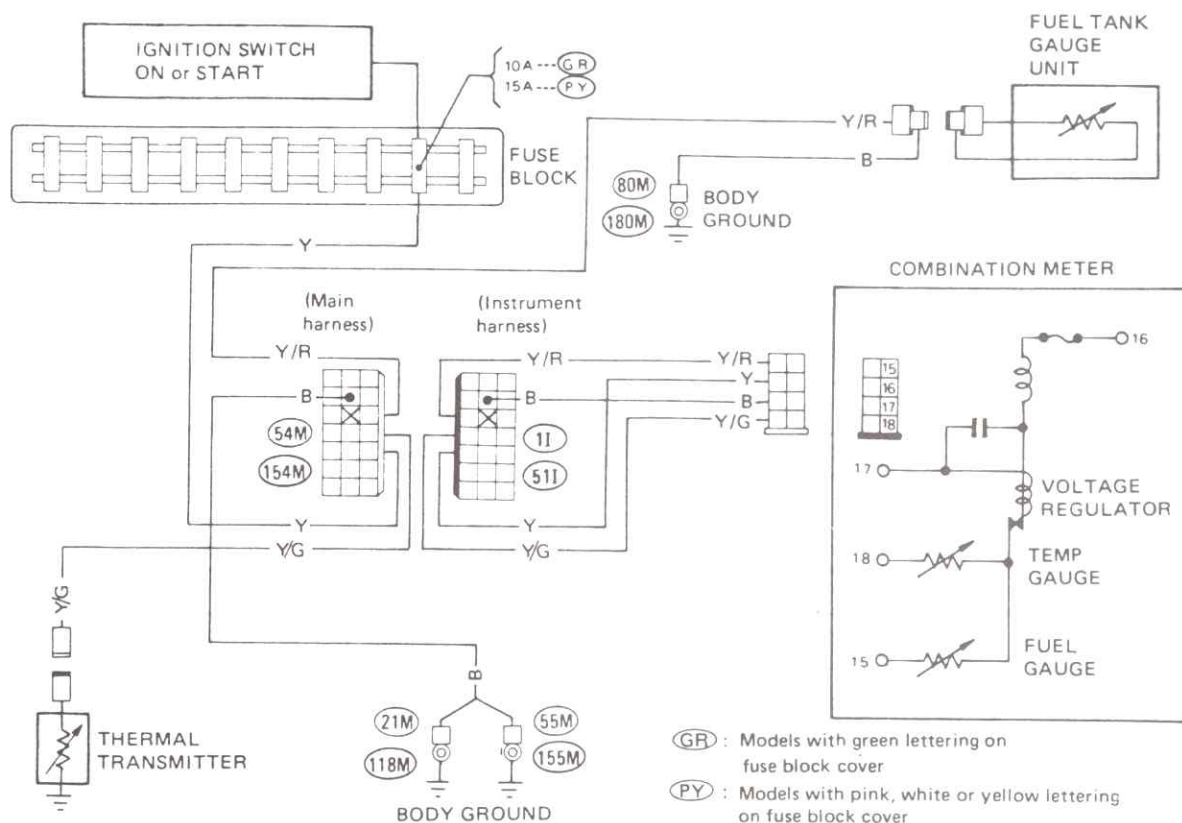


Fig. 12.48 Wiring diagram, fuel and water temperature gauge circuit (1983 to 1984)

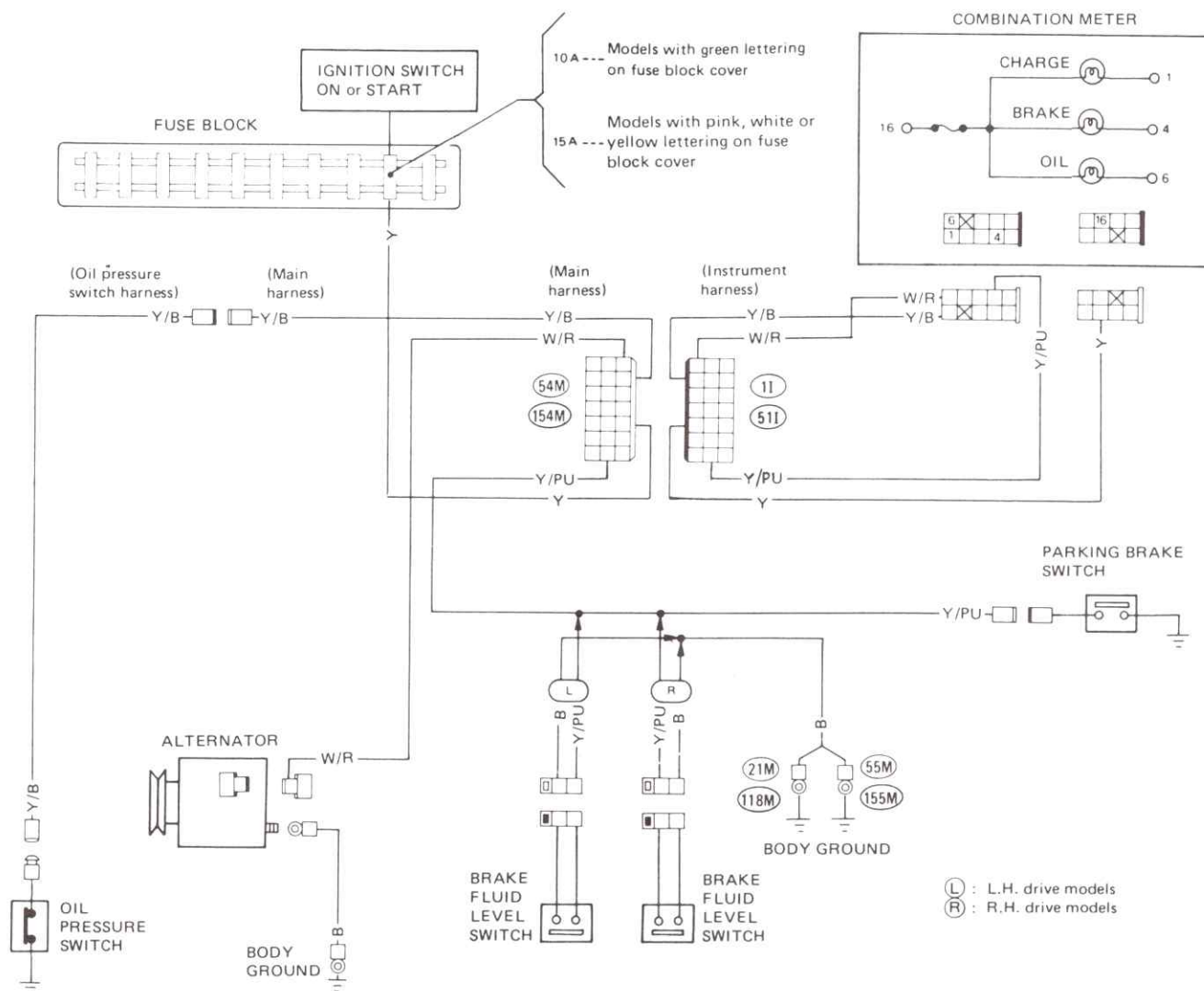


Fig. 12.49 Wiring diagram, warning lights circuit (1983 to 1984)

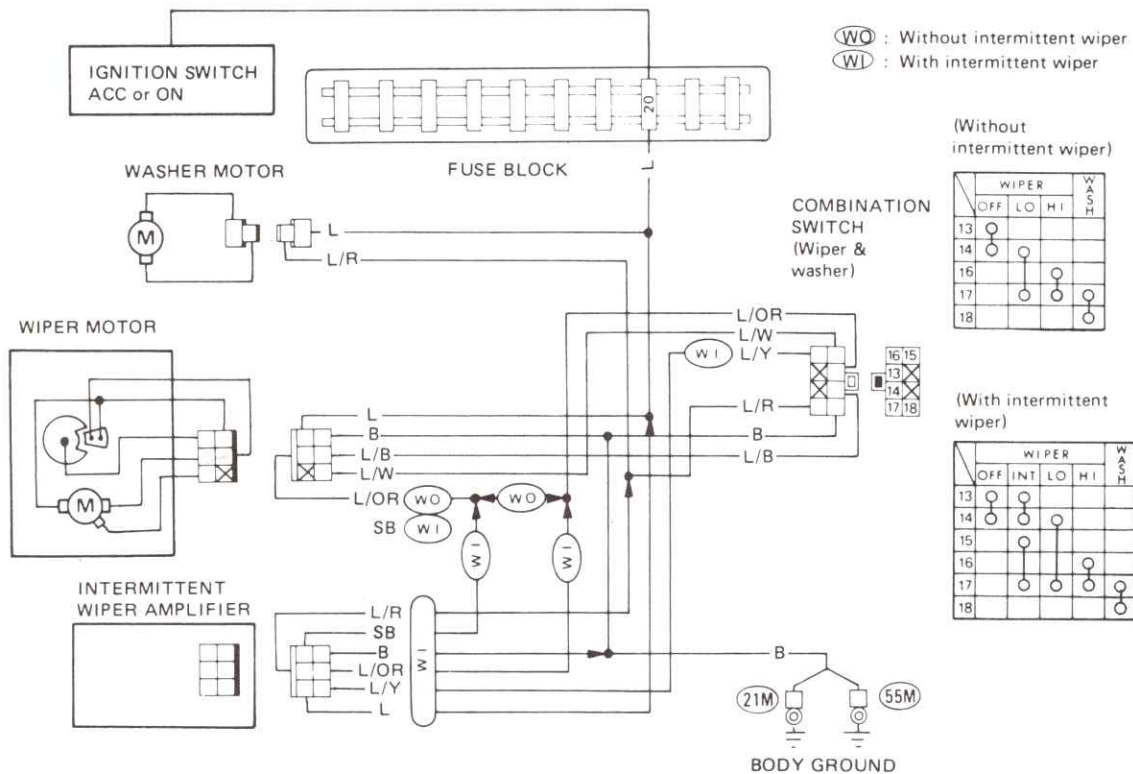


Fig. 12.50 Wiring diagram, windscreen wipe/wash circuit (1983 to 1984)

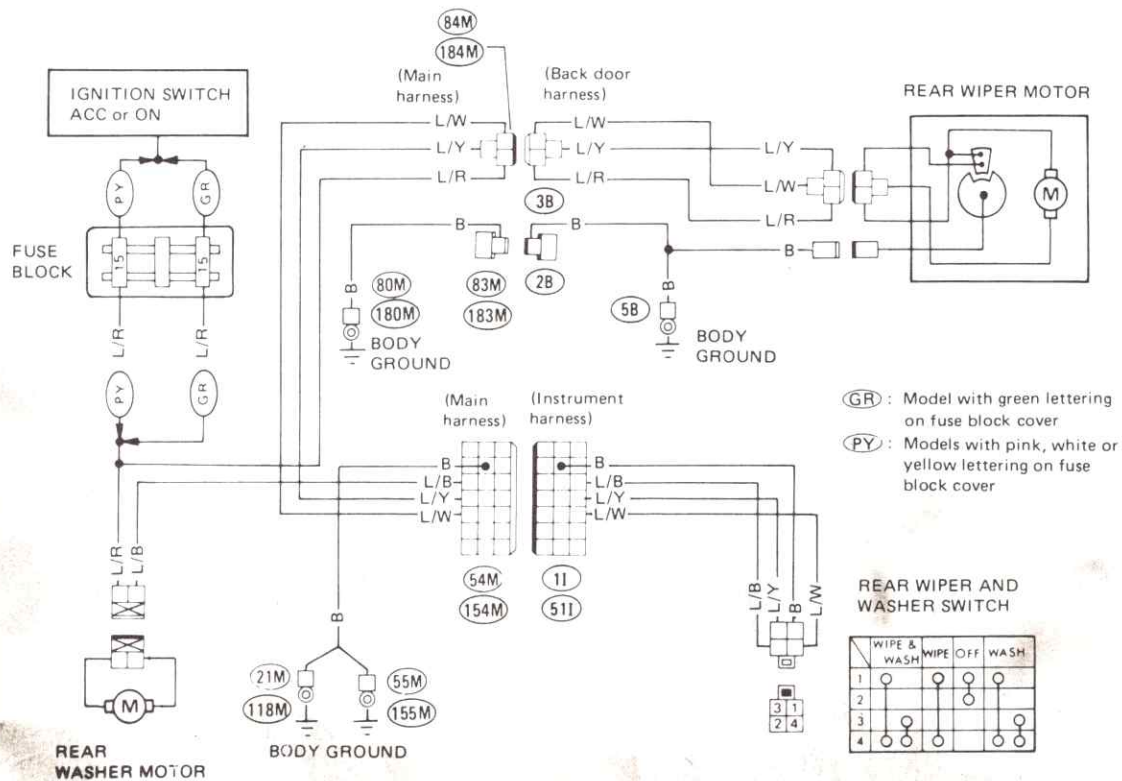


Fig. 12.51 Wiring diagram, rear screen wash/wipe circuit (1983 to 1984)

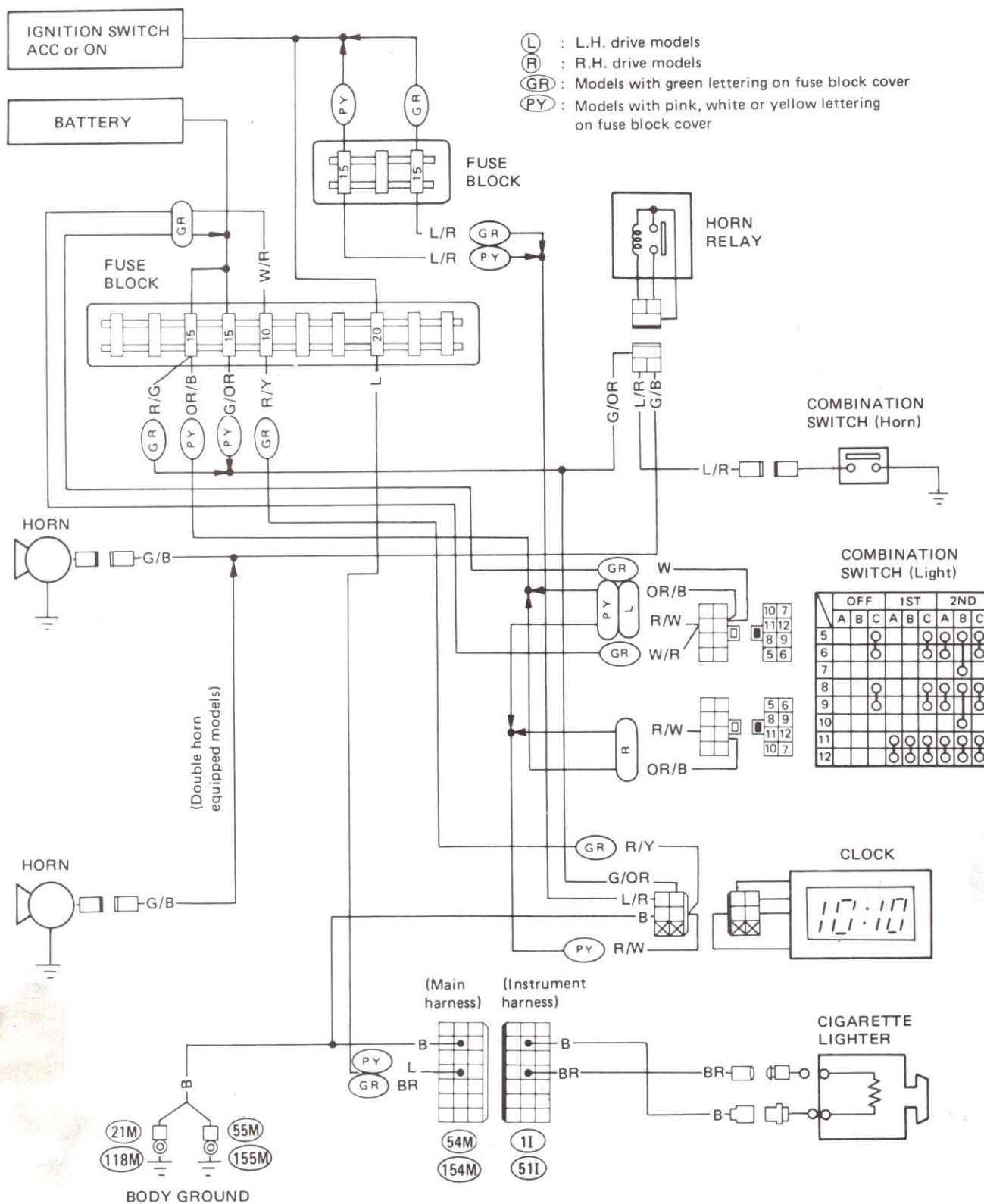


Fig. 12.52 Wiring diagram, horn, cigar lighter and clock circuit (1983 to 1984)

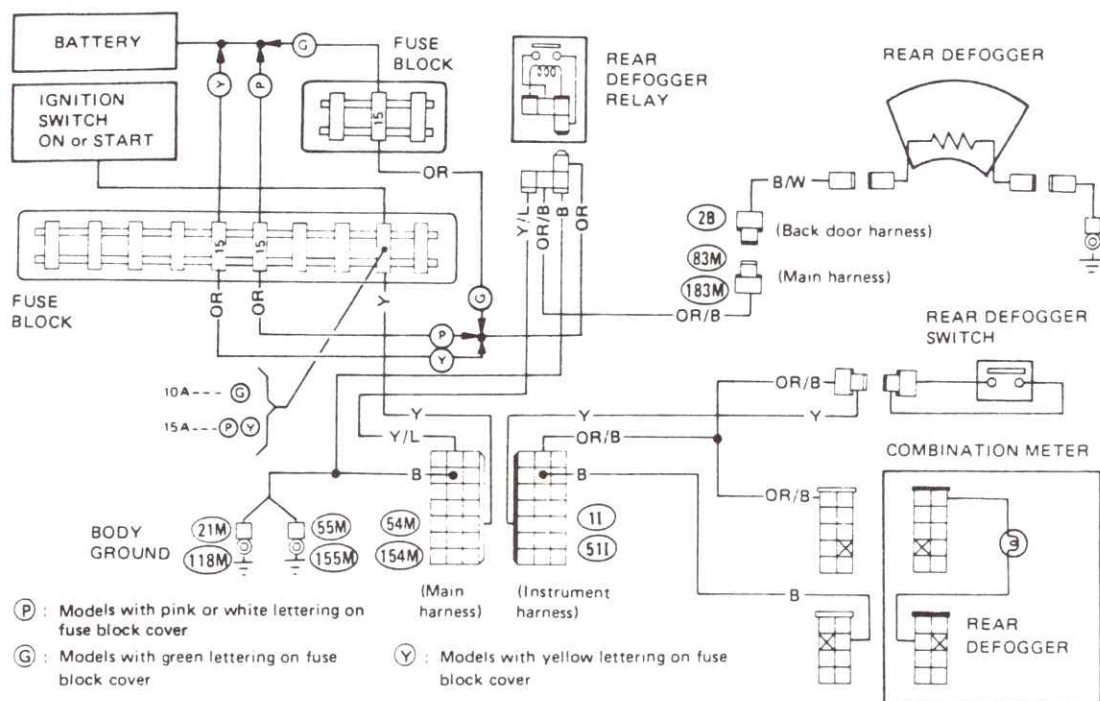


Fig. 12.53 Wiring diagram, rear window demister circuit (1983 to 1984)

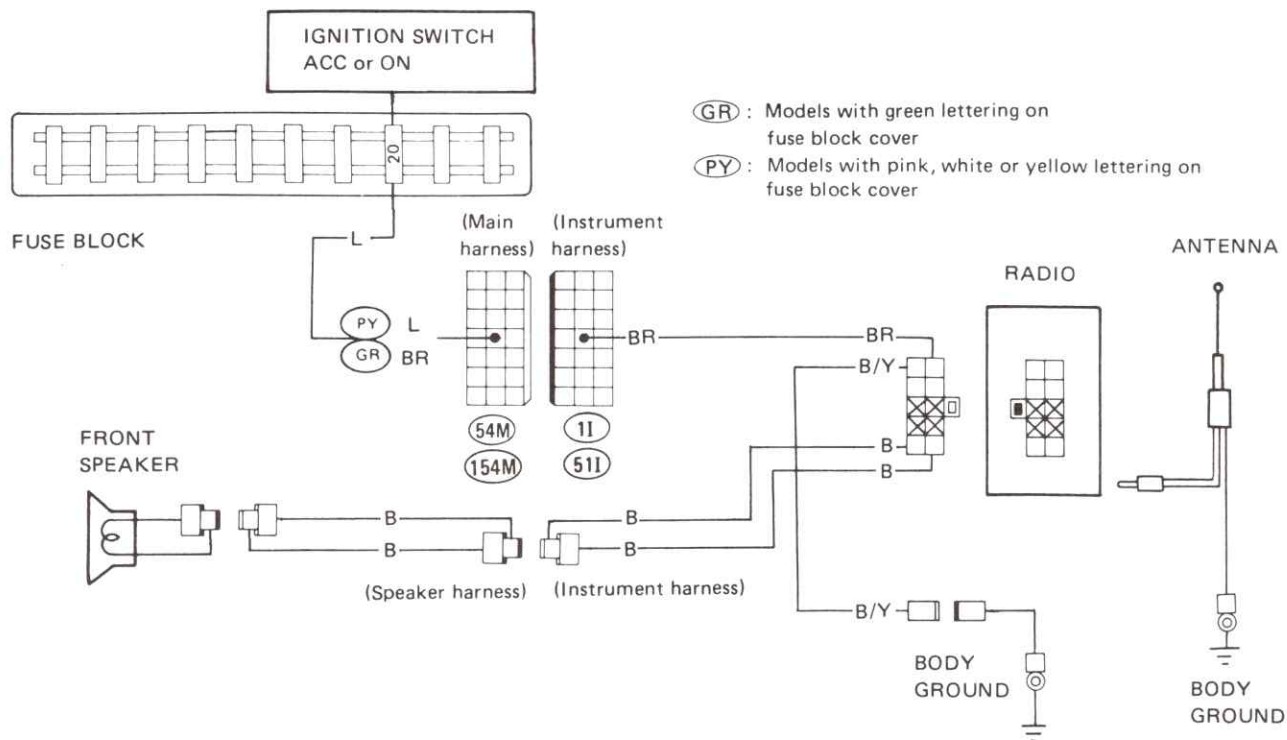


Fig. 12.54 Wiring diagram, radio circuit (1983 to 1984)

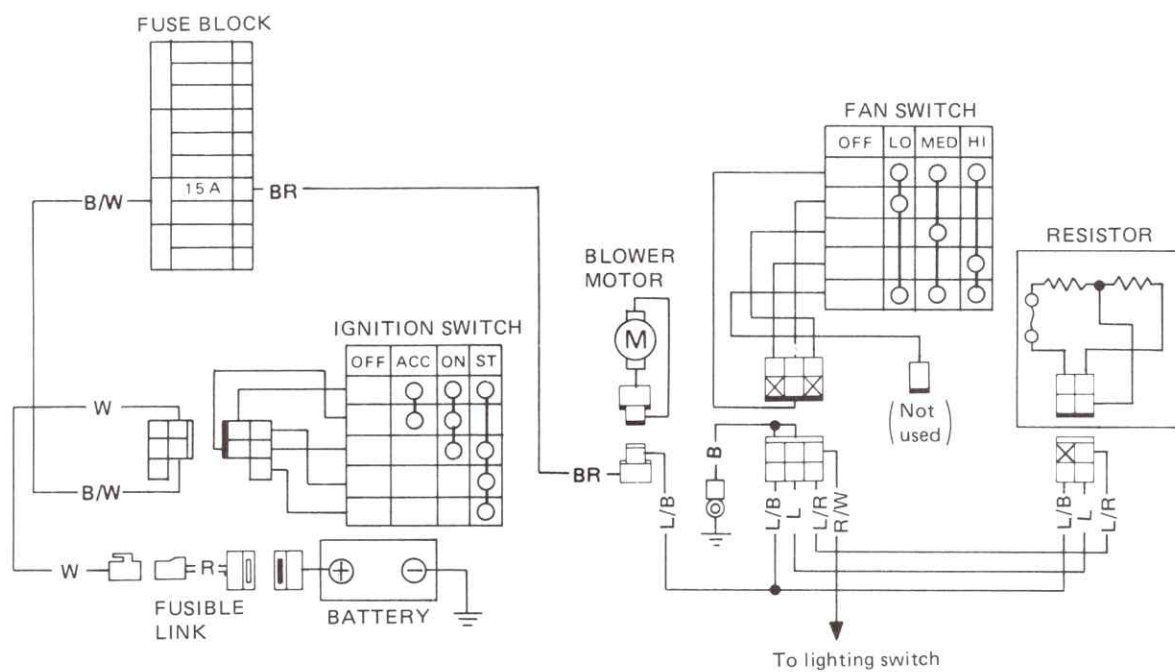


Fig. 12.55 Wiring diagram, heater (1983 to 1984)



Nissan Micra GSX (5-door)

# Chapter 13 Supplement: Revisions and information on later models

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Tailgate exterior handle – removal and refitting		Fuses and relays – location	
Front door and door components (5-door models) – removal			

## 1 Introduction

This Supplement contains information which is additional to, or a revision of, material in the first 12 Chapters.

The Sections in this Supplement follow the same order as the Chapters to which they relate. The Specifications are all grouped together for convenience, but they too follow Chapter order.

It is recommended that before any particular operation is undertaken, reference is made to both the relevant Section of this

Supplement and to the main Chapter so that any changes to procedures or components can be noted before work commences.

Most of the material appearing in this Supplement relates to the model facelifts in June 1985 and again in 1987, the 5-door models introduced in 1987, and the 'S' series models introduced in 1988. Some changes described are retrospective, and apply to earlier models also.

The vehicle used in the preparation of this Supplement and appearing in many of the photographic sequences was a Nissan Micra GSX (5-door) model.

## 2 Specifications

The Specifications given here are supplementary to, or revisions of, those at the beginning of preceding Chapters.

### Engine (all models)

#### General

##### Power output:

Four-speed manual transmission models .....	37 kW (50 bhp) at 6000 rev/min
All other models .....	41 kW (55 bhp) at 6000 rev/min

##### Compression ratio:

Four-speed manual transmission models .....	9.5 to 1
All other models .....	10.3 to 1

#### Piston rings

##### End gap:

2nd ring .....	0.15 to 0.34 mm (0.0059 to 0.0134 in)
Oil control ring .....	0.20 to 0.69 mm (0.0079 to 0.0272 in)

Wear limit (all rings) .....	0.8 mm (0.031 in)
------------------------------	-------------------

#### Pistons

##### Diameter:

Grade 1 .....	67.967 to 67.977 mm (2.6759 to 2.6763 in)
Grade 2 .....	67.977 to 67.987 mm (2.6763 to 2.6766 in)
Grade 3 .....	67.987 to 67.997 mm (2.6766 to 2.6770 in)
Grade 4 .....	67.997 to 68.007 mm (2.6770 to 2.6774 in)
Grade 5 .....	68.007 to 68.017 mm (2.6774 to 2.6778 in)
Oversize .....	68.167 to 68.217 mm (2.6837 to 2.6857 in)

#### Cylinder block

##### Bore:

Grade 1 .....	68.000 to 68.010 mm (2.6772 to 2.6776 in)
Grade 2 .....	68.010 to 68.020 mm (2.6776 to 2.6779 in)
Grade 3 .....	68.020 to 68.030 mm (2.6779 to 2.6783 in)
Grade 4 .....	68.030 to 68.040 mm (2.6783 to 2.6787 in)
Grade 5 .....	68.040 to 68.050 mm (2.6787 to 2.6791 in)
Oversize .....	68.200 to 68.250 mm (2.6850 to 2.6870 in)

#### Crankshaft

##### Crankpin diameter

Undersize .....	39.71 to 39.72 mm (1.5634 to 1.5638 in)
-----------------	---

#### Torque wrench settings

Oil sump bolts (engines with reinforcing straps) .....	lbf ft	kgf m
	3.6 to 5.1	0.5 to 0.7

#### Fuel system

##### Carburettor

##### Type (1985 on):

Manual transmission .....	Hitachi DCZ 306-81A
Automatic transmission .....	Hitachi DCZ 306-82A

##### Type (1987 on):

Manual transmission .....	Hitachi DCZ 306-91
Automatic transmission .....	Hitachi DCZ 306-92

#### Carburettor settings

As given in Chapter 3 except for:

Vacuum break clearance R (1985 on) .....	1.26 ± 0.15 mm (0.0496 ± 0.0059 in)
Primary throttle valve-to-inner wall clearance A (1987 on):	
Manual transmission .....	0.44 ± 0.1 mm (0.0173 ± 0.0039 in)
Automatic transmission .....	0.62 ± 0.1 mm (0.0244 ± 0.0039 in)
Primary and secondary valve plate interlock clearance G (1987 on) ...	5.49 ± 0.5 mm (0.2161 ± 0.0197 in)

#### Manual transmission – from June 1985

##### Ratios

##### Five speed gearbox:

1st .....	3.412 : 1
2nd .....	1.958 : 1
3rd .....	1.323 : 1
4th .....	1.028 : 1
5th .....	0.850 : 1
Reverse .....	3.385 : 1
Final drive .....	4.050 : 1

#### Automatic transmission – from June 1985

Designation .....	RL3F01A
-------------------	---------

**Torque wrench settings**

Oil cooler pipeline banjo unions .....

lbf ft  
22 to 36kgf m  
3 to 5*Driveshafts – from June 1985***Joint bellows**

Grease requirement .....

60 to 90 g (2.12 to 3.17 oz)

Setting length (L):

Inboard joint .....

82.5 mm (3.248 in)

Outboard joint .....

85.5 mm (3.366 in)

*Braking system – from June 1985***Brake pedal**

Depressed height (engine running, force of 110 lb/50 kg) .....

At least 95 mm (3.74 in)

*Suspension and steering***Torque wrench settings**

Upper and lower link mounting bolts .....

lbf ft  
57 to 72kgf m  
7.9 to 9.9

Stabiliser bar mounting bolts .....

29 to 37

4.0 to 5.1

*General dimensions and weights***Dimensions**

Overall length (1985 on) .....

3760 mm (148.0 in)

**Kerb weights kg (lb)**

GSX (3-door) .....

675 kg (1485 lb)

GSX Auto (3-door) .....

705 kg (1554 lb)

Colette (5-door):

Up to 1988 .....

705 kg (1554 lb)

From 1988 .....

675 kg (1485 lb)

GSX (5-door) .....

690 kg (1518 lb)

GSX Auto (5-door) .....

720 kg (1584 lb)

SGL (5-door) .....

715 kg (1576 lb)

SGL Auto (5-door) .....

745 kg (1643 lb)

**3 Routine maintenance**

The routine maintenance schedule for models from 1985 uses revised service intervals as follows. If any doubt exists as to which schedule should be used for a particular model, consult a Nissan dealer.

**Weekly or before a long journey**

- Check engine oil level (Chapter 1, Sec 2)
- Check engine coolant level (Chapter 2, Sec 3)
- Check automatic transmission fluid level (Chapter 7, Sec 3)
- Check brake fluid level (Chapter 9, Sec 2)
- Check all tyres for condition and pressure (including spare) (Chapter 10, Sec 22)
- Check operation of all lights, horn, wipers and washers (Chapter 12)
- Check washer fluid level (Chapter 12, Sec 23)

**Every 9000 miles (15 000 km) or 6 months – whichever comes first**

- Renew engine oil and filter (Chapter 1, Secs 2 and 10)
- Check engine idle speed (Chapter 3, Sec 10)
- Check ignition timing (Chapter 4, Sec 8)
- Renew distributor contact breaker points (Chapter 4, Sec 3)
- Renew spark plugs (Chapter 4, Sec 10)
- Check manual transmission oil level (Chapter 6, Sec 2)
- Check automatic transmission fluid level (Chapter 7, Sec 3)
- Check disc brake pads (Chapter 9, Sec 2)
- Check power steering fluid level and inspect fluid lines for leaks (Chapter 10, Sec 2)
- Check brake, fuel and exhaust systems for leaks, cracks, chafing, deterioration and security
- Lubricate locks, hinges and latches

Check operation of brakes (including handbrake) and clutch (Chapters 5 and 9)

**Every 18 000 miles (30 000 km) or 12 months – whichever comes first***In addition to the 9000 mile service*

- Check valve clearances (Chapter 1, Sec 5)
- Check positive crankcase ventilation system (Chapter 1, Sec 24)
- Check coolant level and antifreeze strength (Chapter 2, Sec 2)
- Check cooling system hoses and connections (Chapter 2, Sec 2)
- Check all drivebelts for cracks, fraying, wear and tension (Chapter 2, Sec 9)
- Renew in-line fuel filter (Chapter 3, Sec 8)
- Renew brake fluid (Chapter 9, Sec 13)
- Check steering gear and linkage, suspension and driveshafts for damage, security and lubrication (Chapters 8 and 10)
- Check wheel alignment and balance (Chapter 10)
- Check drum brake linings (Chapter 9, Sec 4)
- Check front wheel bearing grease (Chapter 10, Sec 5)
- Check seat belts, buckles, retractors, anchor points and adjusters for wear and security (Chapter 11, Sec 25)

**Every 36 000 miles (60 000 km) or 24 months – whichever comes first***In addition to the 18 000 mile service*

- Check brake vacuum servo hoses, connections and non-return valve (Chapter 9, Sec 14)
- Renew engine coolant (Chapter 2, Secs 3 and 4)
- Check fuel lines and connections (Chapter 3)
- Renew air cleaner element (Chapter 3, Sec 3)
- Check ignition wiring (Chapter 4)
- Renew positive crankcase ventilation system filter in air cleaner housing (Chapter 1, Sec 24)

Every 60 000 miles (100 000 km)

Renew the timing belt (Chapter 1, Sec 6)

#### 4 Engine

##### *Oil sump pan – reinforcing straps*

- 1 Later engines have reinforcing straps fitted under the sump retaining bolts.
- 2 Note the increased torque loading figure for sump retaining bolts on engines fitted with reinforcing straps (see Specifications in this Supplement).

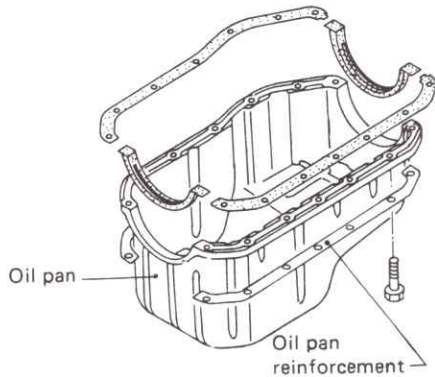


Fig. 13.1 Oil sump pan reinforcing straps (Sec 4)

##### *Cylinder bores, pistons and piston rings – grading*

- 3 After manufacture, the cylinder bores are measured and the appropriate grade pistons and rings fitted.
- 4 In service, if it becomes necessary, the cylinder bores may be honed to take up wear and minor imperfections, provided that the maximum oversize is not exceeded.
- 5 If the oversize is exceeded (see Specification tables in this Supplement), the cylinder block will have to be rebored.

##### *Cylinder block – reboring*

- 6 If the degree of wear in any one cylinder bore is such that it cannot be remedied by honing, the cylinders can be rebored.
- 7 Reboring is a task for a specialist with the necessary equipment, who will also supply (and fit if required) the correct oversize pistons and rings to match the rebore size.
- 8 Note that even if only one cylinder is worn beyond limits, all four cylinders must be rebored. It is not permissible to rebore only one cylinder.

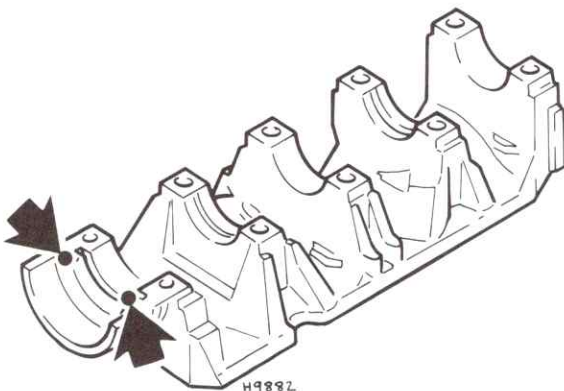


Fig. 13.2 Apply sealant to arrowed areas when refitting the main bearing cap (Sec 4)

##### *Main bearing cap – refitting*

- 9 When refitting the main bearing cap as described in Chapter 1, Section 20, apply a dab of sealant to the areas shown in Fig. 13.2.
- 10 Allow sufficient time for the sealant to harden before starting the engine.

#### 5 Cooling system

##### *Radiator – automatic transmission models*

- 1 The radiator on later models fitted with automatic transmission incorporates an oil cooler along its bottom edge to cool the automatic transmission fluid.
- 2 When removing a radiator on these models, disconnect the oil cooler pipe lines by undoing the worm drive clips securing the flexible hoses to the radiator connections.
- 3 Blank off the ends of the pipe lines to prevent entry of dirt.
- 4 After refitting, check the oil cooler connections for leaks with the engine running.

**Note:** See also Section 8 of this Supplement.

#### 6 Fuel and exhaust systems

##### *Carburettor – modifications*

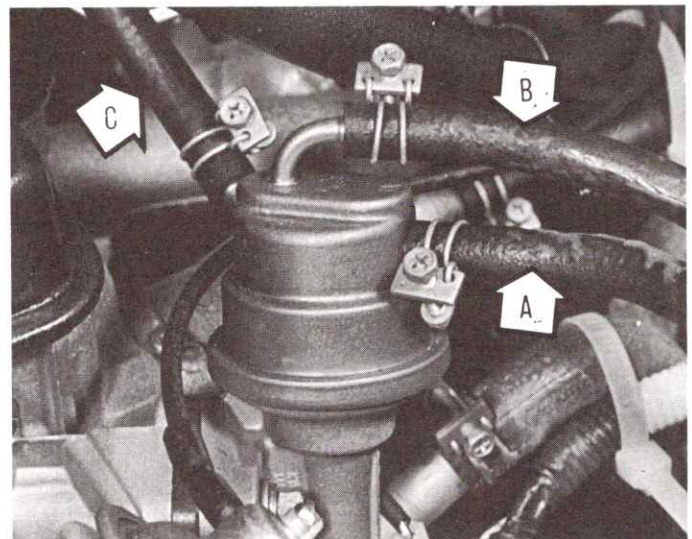
- 1 Revised versions of the Hitachi carburettor are fitted to later models.
- 2 Overhaul and adjustment procedures remain basically the same as described in Chapter 3, but using the specifications given in this Supplement.

##### *Fuel pump (1987 on) – fuel return hose*

- 3 From 1987, the fuel pump cover has been modified to include a fuel return line to the fuel tank for excess fuel (photo).
- 4 On earlier models the return hose was fitted to the carburettor (see Fig. 3.2 in Chapter 3).
- 5 Fuel pump removal and overhaul procedures remain as described in Chapter 3.

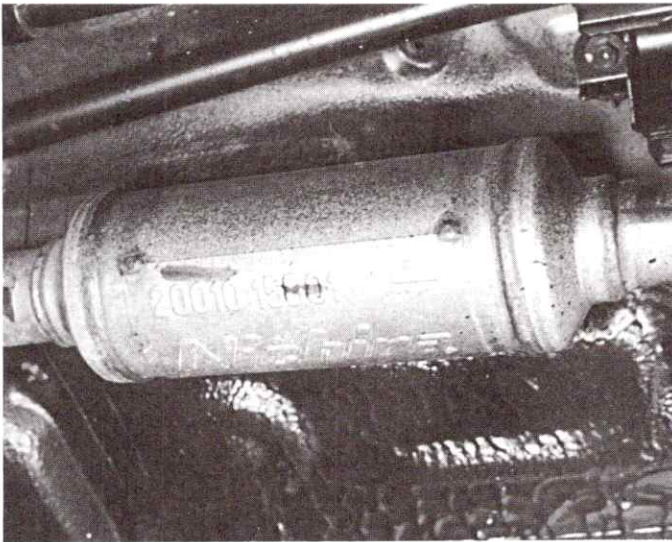
##### *Exhaust system (1985 on) – modification*

- 6 Manual transmission models have an additional pre-muffler welded to the exhaust system between the downpipe and the existing pre-muffler (photo).



6.3 Fuel pump on 1987 on models

- |               |                       |
|---------------|-----------------------|
| A Inlet hose  | C Hose to carburettor |
| B Return hose |                       |



6.6 Exhaust pre-muffler fitted to 1985 on manual transmission models

## 7 Automatic transmission

### Oil cooler

- 1 Post 1985 automatic transmission models are fitted with water-cooled oil coolers.
- 2 The oil cooler is integral with the cooling system radiator, the automatic transmission fluid being fed and returned to the cooler via two banjo unions on the transmission casing, and two pipe lines.
- 3 The connections at the radiator end are by flexible pipes, secured with worm drive clips.
- 4 When removing the transmission unit, as described in Chapter 7, disconnect the cooler pipes at the transmission housing banjo unions, blanking off the open ends to prevent ingress of dirt.
- 5 Similarly, when removing the radiator, as described in Chapter 2, disconnect and blank off the unions at the radiator.
- 6 The fluid is not under pressure and only a small amount of fluid will be lost.
- 7 On reconnecting the pipes at the transmission housing banjo unions, tighten the unions to the specified torque, and check for leaks with the engine running.

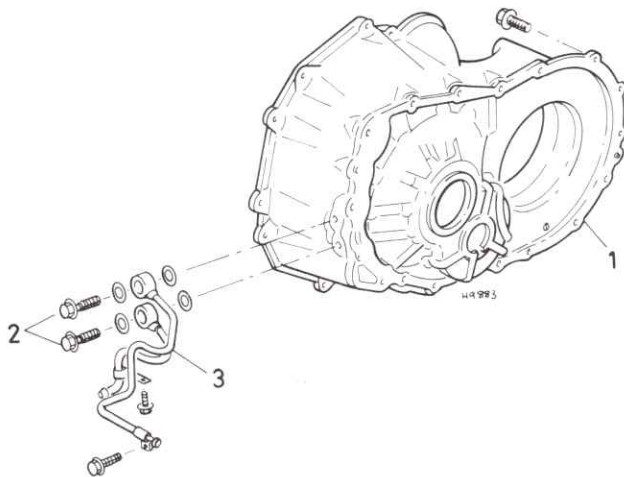


Fig. 13.3 Automatic transmission oil cooler pipe banjo unions on transmission casing (Sec 7)

- |                       |         |
|-----------------------|---------|
| 1 Transmission casing | 3 Pipes |
| 2 Banjo bolts         |         |

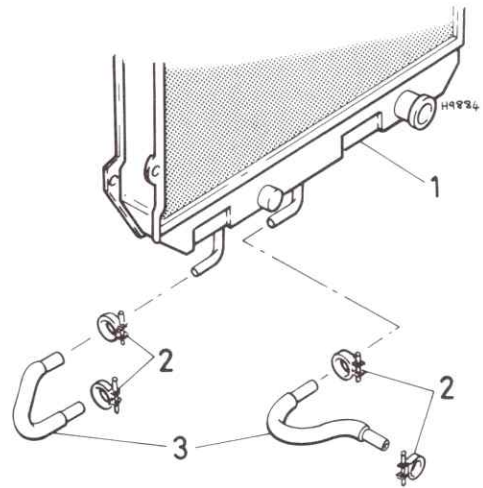


Fig. 13.4 Automatic transmission oil cooler connections at radiator (Sec 7)

- |                    |                  |
|--------------------|------------------|
| 1 Radiator         | 3 Flexible hoses |
| 2 Worm drive clips |                  |

## 8 Braking system

### Brake master cylinder

- 1 The manufacturer may fit master cylinders from various suppliers, and the internal diameter of these cylinders differs according to source.
- 2 It is important, therefore, when ordering repair kits, to know which make of master cylinder is fitted to your vehicle, in order that the correct kits are obtained.

### Rear wheel cylinder

- 3 The comments made in the preceding paragraphs about different suppliers applies also to the rear wheel cylinder.
- 4 Although externally similar, the internal seals and piston are different, and there is no interchangeability between makes.
- 5 When ordering repair kits, quote the manufacturer's name.

### Brake pedal (1985 on)

- 6 Note the revised brake pedal depressed height given in the Specifications section of this Supplement.

## 9 Suspension and steering

### Rear suspension – stabiliser bar

- 1 Models produced since 1985 have provision for the fitting of a rear stabiliser bar, which is an item of optional equipment.

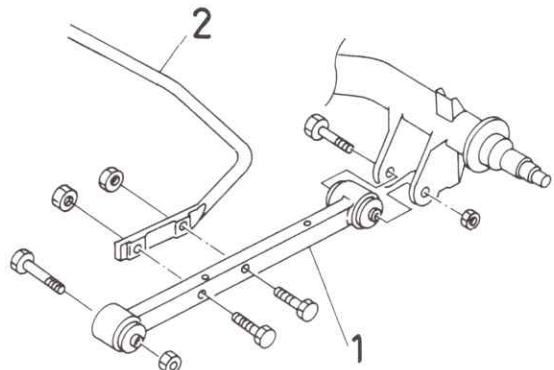
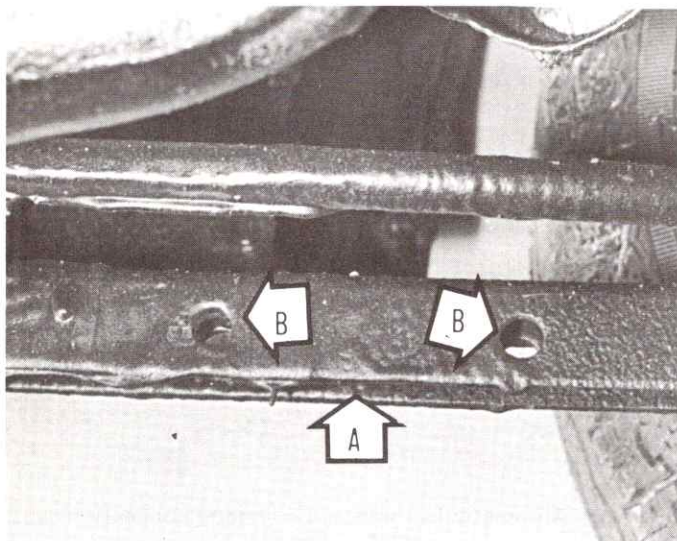


Fig. 13.5 Rear suspension lower link and stabiliser bar attachment point (Sec 9)

- |              |                  |
|--------------|------------------|
| 1 Lower link | 2 Stabiliser bar |
|--------------|------------------|



9.2 Later type lower link with stabiliser bolt holes

A Lower link      B Bolt holes

2 The stabiliser bar is bolted between the two lower links. In order to achieve this, the lower link profile has been changed from round section to square section (photo).

3 When refitting a stabiliser bar, tighten the mounting bolts to the specified torque given in the Specifications section of this Supplement.

#### *Steering wheel (later models) – removal and refitting*

4 On later models the steering wheel centre cover horn push arrangement may differ slightly from that described in Chapter 10, Section 16.

5 In general, to remove the horn push, undo the screws securing the 'Nissan' motif to the steering wheel. The screws are accessible from the underside of the steering wheel.

6 Remove the motif, and then undo the screws securing the horn push to the steering wheel. These are recessed into the plastic moulding of the horn push (photo).

7 The remainder of the procedure is as described in Chapter 10, Section 16.

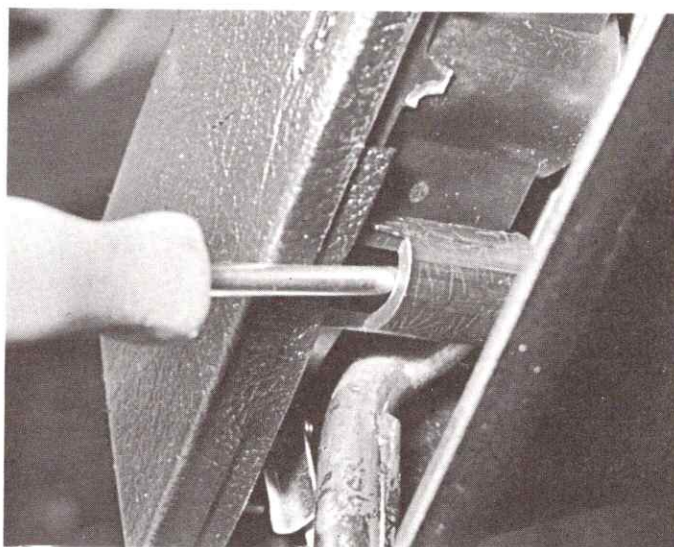
### **10 Bodywork and fittings**

#### *Minor body damage – repair of plastic components*

1 With the use of more and more plastic body components by the vehicle manufacturers (eg bumpers, spoilers, and in some cases major body panels), rectification of more serious damage to such items has become a matter of either entrusting repair work to a specialist in this field, or renewing complete components. Repair of such damage by the DIY owner is not really feasible owing to the cost of the equipment and materials required for effecting such repairs. The basic technique involves making a groove along the line of the crack in the plastic using a rotary burr in a power drill. The damaged part is then welded back together by using a hot air gun to heat up and fuse a plastic filler rod into the groove. Any excess plastic is then removed and the area rubbed down to a smooth finish. It is important that a filler rod of the correct plastic is used, as body components can be made of a variety of different types (eg polycarbonate, ABS, polypropylene).

2 Damage of a less serious nature (abrasions, minor cracks etc) can be repaired by the DIY owner using a two-part epoxy filler repair material. Once mixed in equal proportions, this is used in similar fashion to the bodywork filler used on metal panels. The filler is usually cured in twenty to thirty minutes, ready for sanding and painting.

3 If the owner is renewing a complete component himself, or if he has repaired it with epoxy filler, he will be left with the problem of finding a suitable paint for finishing which is compatible with the type of plastic used. At one time the use of a universal paint was not possible owing to the complex range of plastics encountered in body



9.6 Removing a screw from the horn push on later models

component applications. Standard paints, generally speaking, will not bond to plastic or rubber satisfactorily. However, it is now possible to obtain a plastic body parts finishing kit which consists of a pre-primer treatment, a primer and coloured top coat. Full instructions are normally supplied with a kit, but basically the method of use is to first apply the pre-primer to the component concerned and allow it to dry for up to 30 minutes. Then the primer is applied and left to dry for about an hour before finally applying the special coloured top coat. The result is a correctly coloured component where the paint will flex with the plastic or rubber, a property that standard paint does not normally possess.

#### *Radiator grille (1987 on) – removal and refitting*

4 The procedure is as described in Chapter 11, Section 7, but the left hand clip (viewed from the front of the car) is now located beneath a plastic cover which is removed in the same manner as the 'Nissan' motif.

#### *Bumpers – 1985 on*

5 The bumpers fitted to models after the 1985 facelift consist of a plastic compound fascia fitted over a steel reinforcement bar.

6 The reinforcement bar is bolted to the frame, and the fascia is clipped to the reinforcement bar.

7 When refitting a bumper, tighten the mounting bolts and nuts to the torque figures given in the Specifications of this Supplement.

#### *Tailgate exterior handle – removal and refitting*

8 Open the tailgate and remove the interior cover panel.

9 Remove the two nuts securing the handle to the tailgate skin.

10 Lift off the handle.

11 Refit in reverse order.

#### *Front door and door components (5-door models) – removal and refitting*

12 The front doors on 5-door models are narrower than those on 3-door models, but the procedure for removal and refitting of the door, door trim, locks and handles is as described in Chapter 11. Note that the armrest is secured by two screws and not three.

#### *Rear door interior trim panel – removal and refitting*

13 Unscrew and remove the door lock plunger knob.

14 Prise out and remove the moulding from around the interior handle (photo).

15 Remove the window regulator handle, as described in Chapter 11, Section 13.

16 Prise back the plastic covers on the armrest and remove the screws, then lift off the armrest (photo).

17 Carefully prise out the clips securing the trim panel to the door using a wide bladed screwdriver.

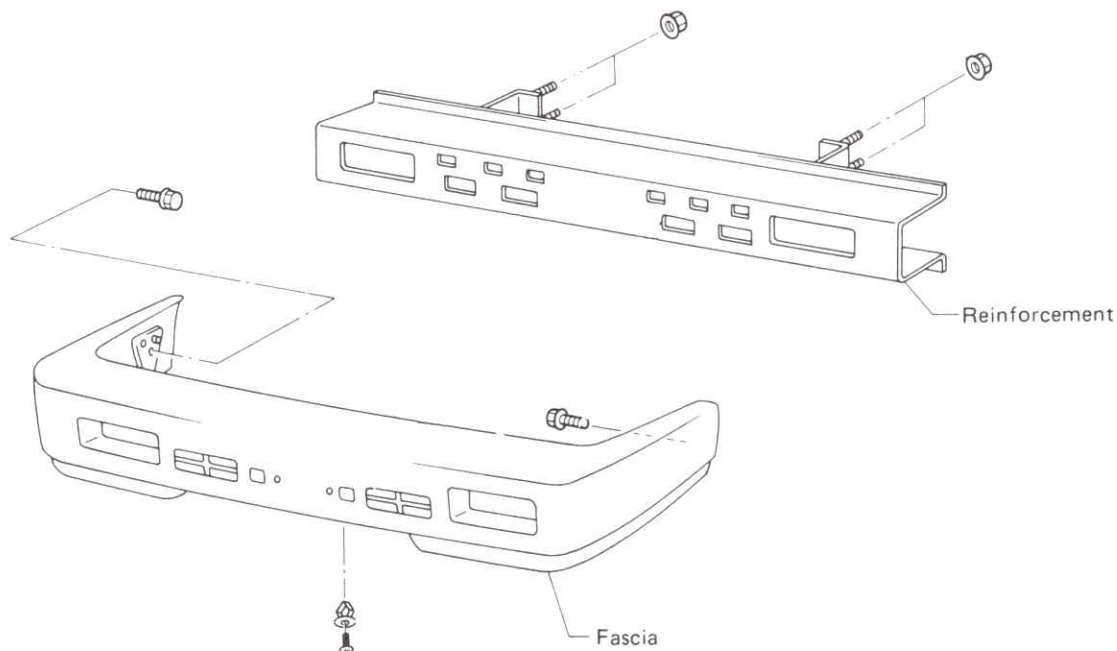


Fig. 13.6 Front bumper assembly (1985 on) (Sec 10)

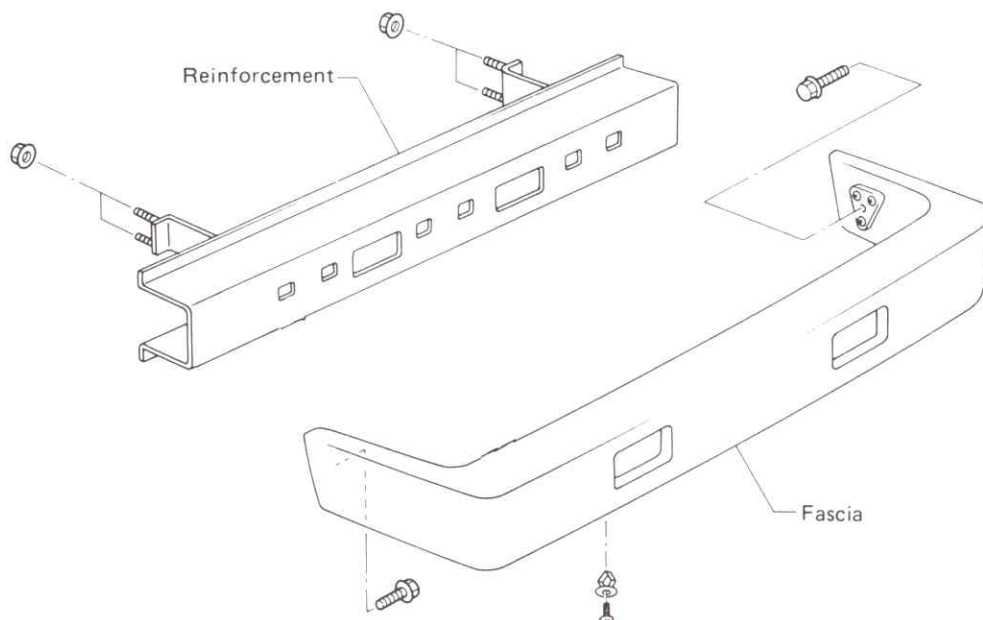
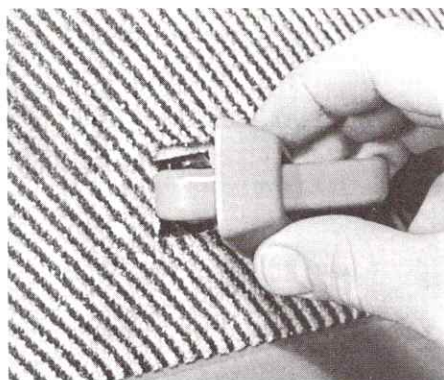
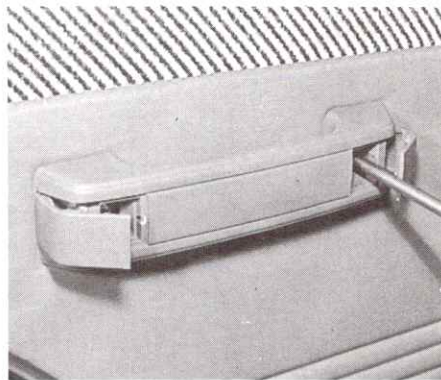


Fig. 13.7 Rear bumper assembly (1985 on) (Sec 10)



10.14 Removing the moulding from the interior handle



10.16 Removing the screws from the rear armrest

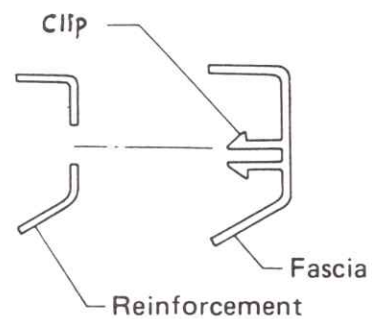


Fig. 13.8 Bumper fascia-to-reinforcement bar attachment (Sec 10)

18 Peel back the plastic sheeting from the door. It is important that this sheet is kept intact and refitted to prevent moisture penetrating the fibre door trim panel.

19 Refitting is a reversal of removal.

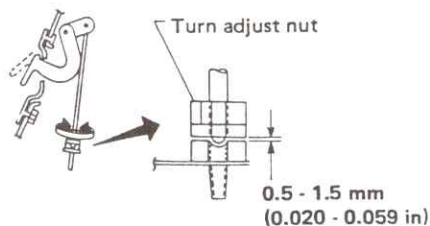
#### *Rear door exterior handle – removal and refitting*

20 Remove the interior trim panel as described in the preceding paragraphs.

21 Remove the two nuts securing the handle to the door, accessible through the upper door aperture (photo).

22 Unhook the link rod between the handle and the door lock, and lift off the handle.

23 Refit in reverse order and turn the adjuster on the link rod to give the clearance shown in Fig. 13.9.



**Fig. 13.9 Rear door exterior handle link rod adjustment (Sec 10)**

#### *Rear door interior handle – removal and refitting*

24 Remove the door interior trim panel, as described in paragraphs 13 to 19.

25 Remove the two securing screws and lift off the handle, at the same time disconnecting the link rod (photo).

26 Refit in reverse order.

#### *Rear door lock plunger mechanism – removal and refitting*

27 Remove the door interior trim panel, as described in paragraphs 13 to 19.

28 Undo the screw securing the bellcrank to the door (photo).

29 Unhook the bellcrank from the link rod and remove it from the door.

30 Refit in reverse order.

#### *Rear door lock – removal and refitting*

31 Remove the interior trim panel, as described in paragraphs 13 to 19.

32 Unhook the control rods from the exterior handle, lock plunger and interior handle.

33 Remove the three retaining screws and lift out the lock assembly (photos).

34 Refitting is a reversal of removal, but it will be found easier to reconnect the exterior handle link rod if the handle is first removed. The adjuster on the link rod will then have to be turned to give the clearance shown in Fig. 13.9.

#### *Rear door window and quarter-light – removal and refitting*

35 Remove the door interior trim panel, as described in paragraphs 13 to 19.

36 Lower the window to gain access to the two bolts securing the window to the lift mechanism (photo).

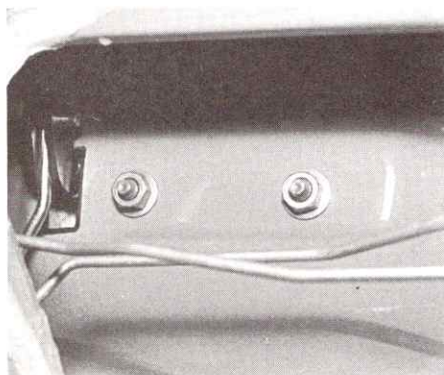
37 Remove the two bolts, and carefully lower the window into the bottom of the door.

38 Prise off the door weatherstrip moulding from the bottom of the window aperture, and pull out the rubber channelling in the door window recess.

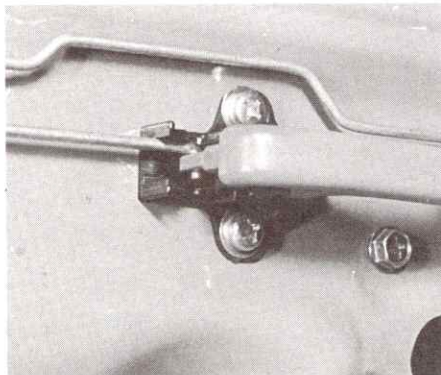
39 Remove the rear window guide channel, held by a screw at the top and a bolt at its lower end.

40 The window can now be lifted out of the door.

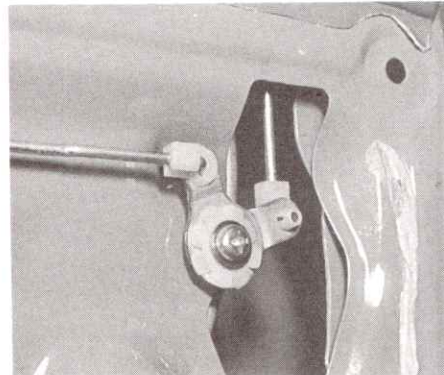
41 The rear quarter-light is removed by pulling it forward and out of the door.



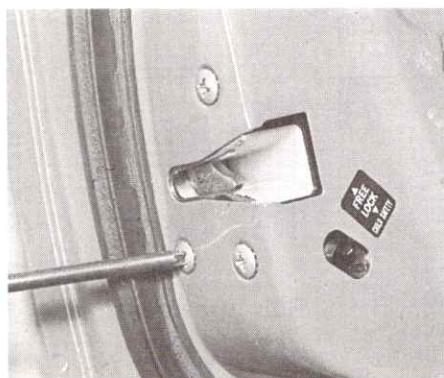
**10.21 Rear door exterior handle securing nuts**



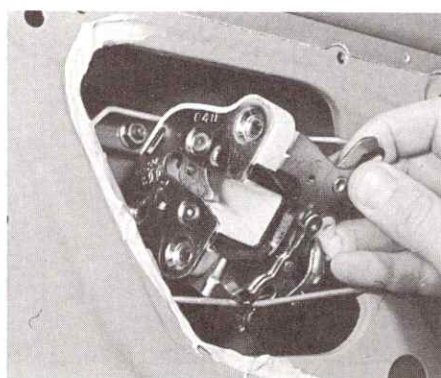
**10.25 Interior handle securing screws and link rod**



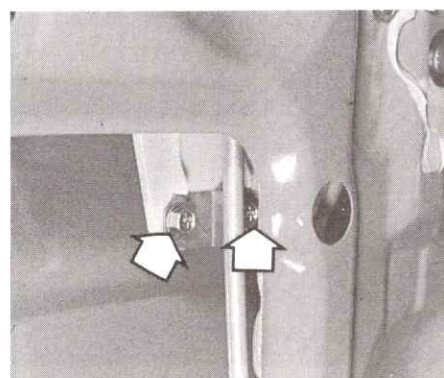
**10.28 Bellcrank securing screw**



**10.33A Removing the rear door lock assembly securing screws**



**10.33B Lifting the lock assembly from the door**



**10.36 Window-to-lift mechanism securing bolts (arrowed)**

42 Refitting is a reversal of removal. Adjust the guide channel and glass position as necessary to obtain smooth operation.

#### *Rear window lift mechanism – removal and refitting*

43 Remove the rear window as described in paragraphs 35 to 40.

44 Remove the bolts securing the window regulator and lift mechanism to the door inner skin. There is also a plastic clip at the bottom of the door which has to be released (photos).

45 Carefully manoeuvre the mechanism out of the lower aperture in the door, being careful not to bend it excessively.

46 Refitting is a reversal of removal, adjusting the securing bolts to give smooth operation of the lift mechanism.

#### *Rear door – removal and refitting*

47 The procedure for removing the rear door is similar to that described for the front door in Chapter 11, Section 17.

#### *Front passenger seat (3-door models) – walk-in device*

48 In addition to the normal tilt mechanism operating handle mounted on the side of the front passenger seat, there is a cable-operated release handle at the rear of the seat, enabling rear seat passengers to more readily tilt the seatback forward.

49 This cable is non-adjustable and if it stretches or breaks, it should be renewed.

50 Access to the mechanism is by removal of the cover panel, held by two screws (photo).

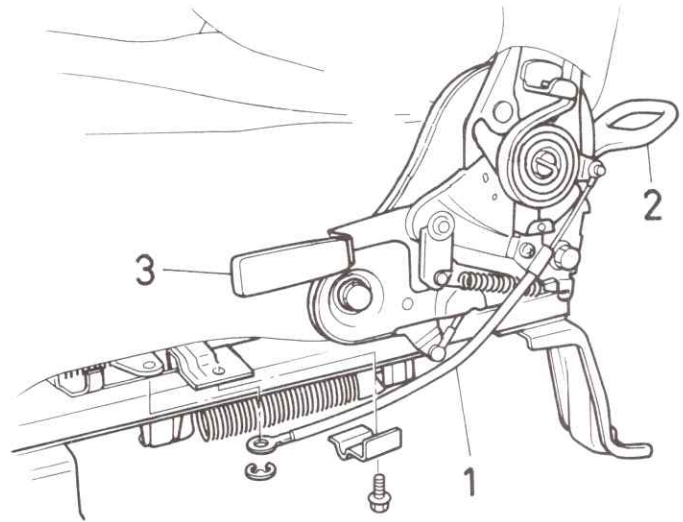
51 The cable is held on its spigots by C-clips (photo).

52 To keep the mechanism operating smoothly, grease all moving parts at regular intervals.

#### *Head restraints – general*

53 Later models are fitted with adjustable, removable head restraints on the front seats.

54 Adjustment and removal is achieved by depressing the catch at the side of the head restraint socket in the seat back (photo).



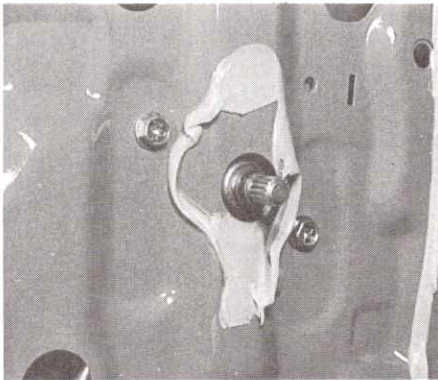
**Fig. 13.10 Front passenger seat walk-in device mechanism (3-door models) (Sec 10)**

- 1 Operating cable  
2 Passenger handle

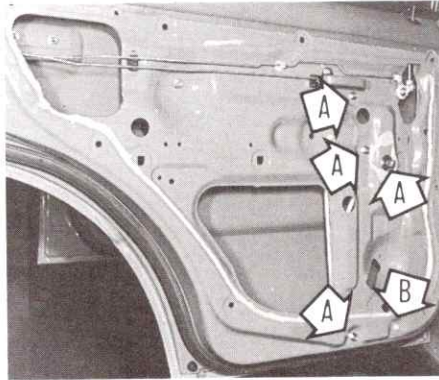
- 3 Normal operating lever

#### *Glove box lid and lock – removal and refitting*

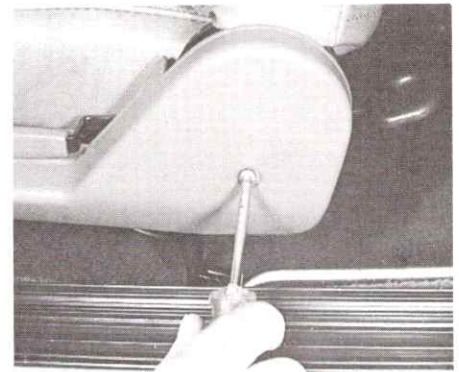
55 Open the glove box lid and remove the screws from the lid back panel (photo).



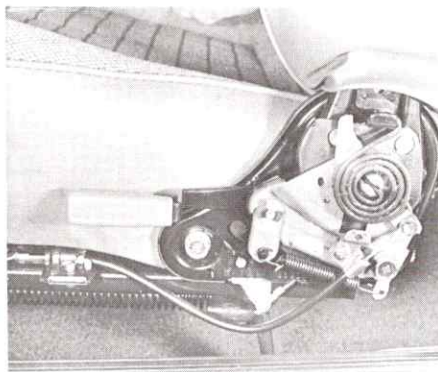
10.44A Regulator securing bolts



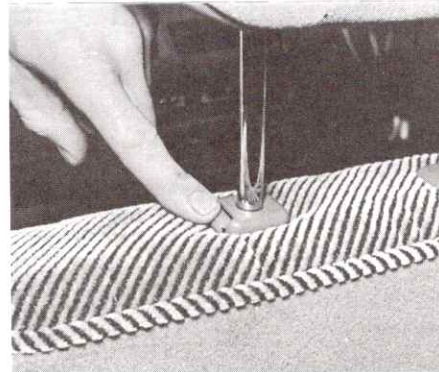
10.44B Lift mechanism bolts (A) and plastic clip (B)



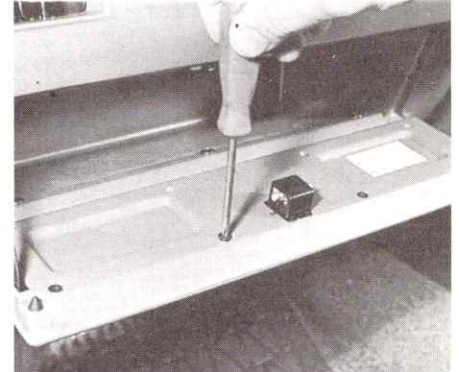
10.50 Removing the cover from the walk-in device



10.51 Walk-in device with cover removed



10.54 Adjustable head restraint catch



10.55 Removing a screw from the glove box lid back panel

- 56 Lift up the back panel and remove the screws from the stay bracket (photo).
- 57 Drop the back panel down again and remove the screws from the hinge inside the glove box (photo).
- 58 Remove the lid and lift the back panel from the stay bracket.
- 59 The lock assembly is held in the lid by plastic clips (photos).
- 60 Refit in reverse order, feeding the stay bracket through the back panel before fitting the lid.

#### *Parcel shelf – removal and refitting*

- 61 Remove the screw securing the shelf to the bracket at its outboard edge (photo) and the two screws securing it at its inboard edge.
- 62 Pull the shelf forwards to release it from the clip at the back (photo).
- 63 Refit in reverse order.

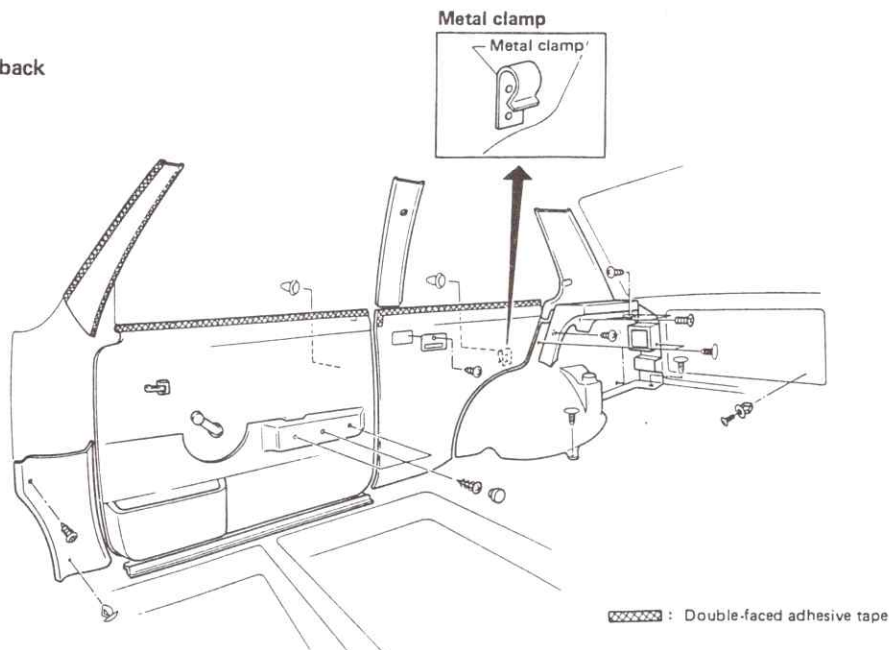
#### *Interior trim panels – general*

- 64 The location of the interior trim panel fixing screws and clips for both 3 and 5-door models is shown in Fig. 13.11.
- 65 On 5-door models the 'B' pillar trim panels are held in place by the door edge capping, which when pulled back allows the trim to be removed (photo).

#### *Stone chip guard – removal and refitting*

- 66 Some models are fitted with a stone chip guard in front of the rear wheel arches.
- 67 The guard, which is made of a plastic material, is held in position by three screws and double sided adhesive tape (photo).
- 68 When removing a stone guard, the application of gentle heat will ease the removal of the guard from the adhesive tape.
- 69 Similarly, the application of heat will increase the adhesion

#### 3-door Hatchback



#### 5-door Hatchback

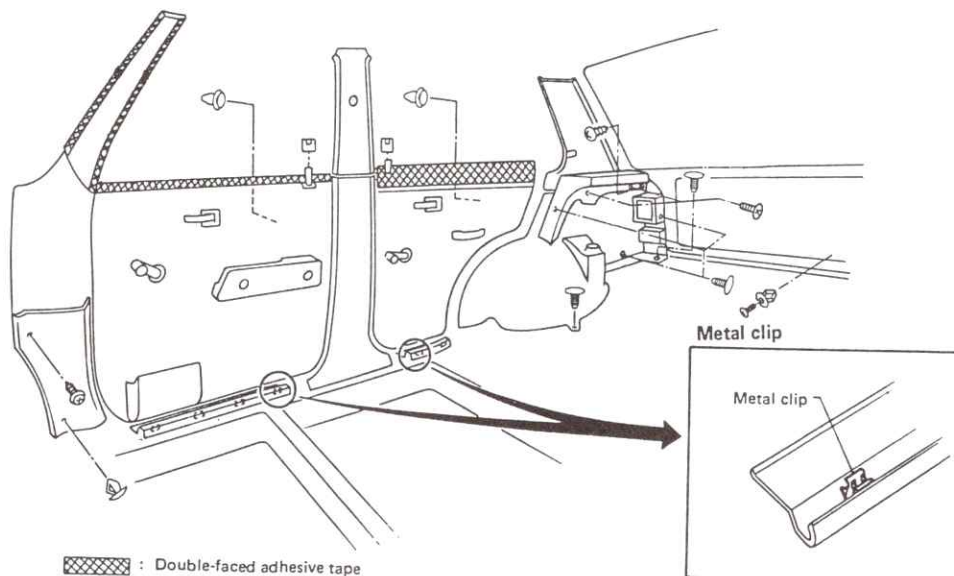
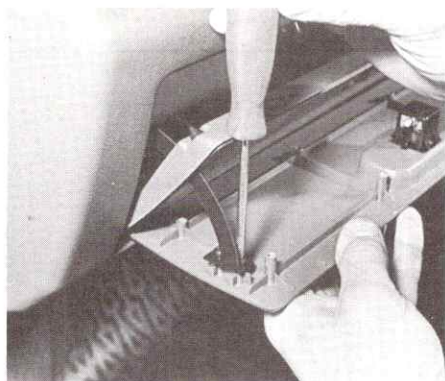
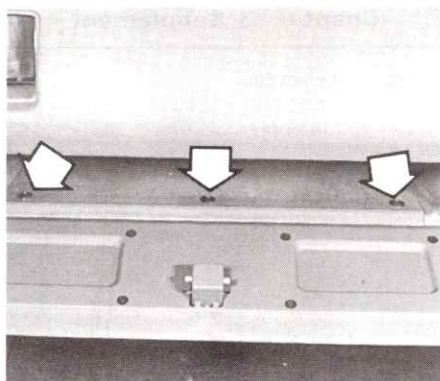


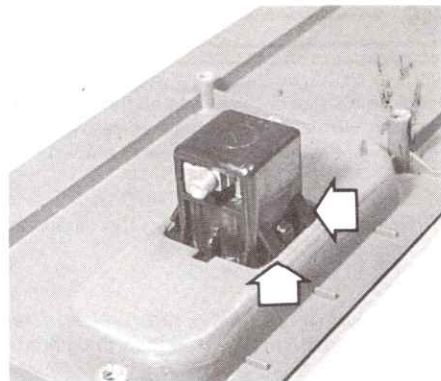
Fig. 13.11 Interior trim panels on 3 and 5-door models (Sec 10)



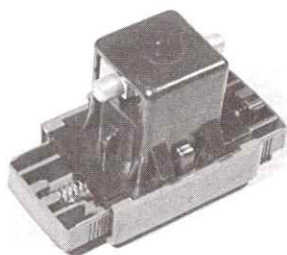
10.56 Removing the screws from the stay bracket



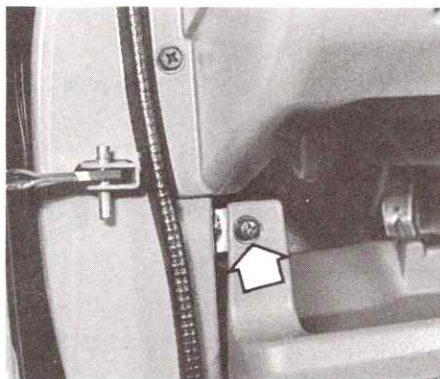
10.57 Glove box lid hinge retaining screws (arrowed)



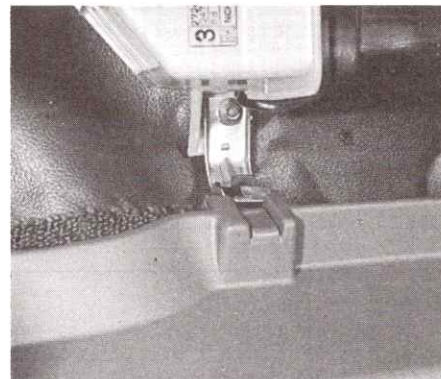
10.59A Plastic clips secure the lock assembly (arrowed)



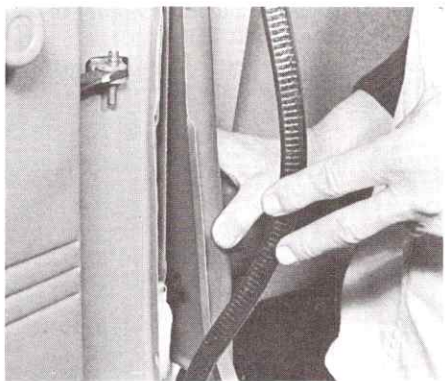
10.59B Lock assembly removed from the lid



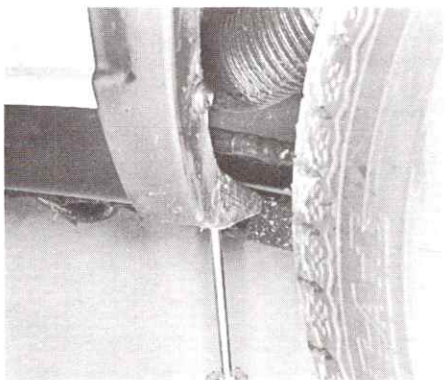
10.61 Parcel shelf outboard edge securing screw (arrowed)



10.62 Parcel shelf rear securing clip



10.65 Removing a 'B' pillar trim panel on 5-door model



10.67 Removing a retaining screw from the stone chip guard

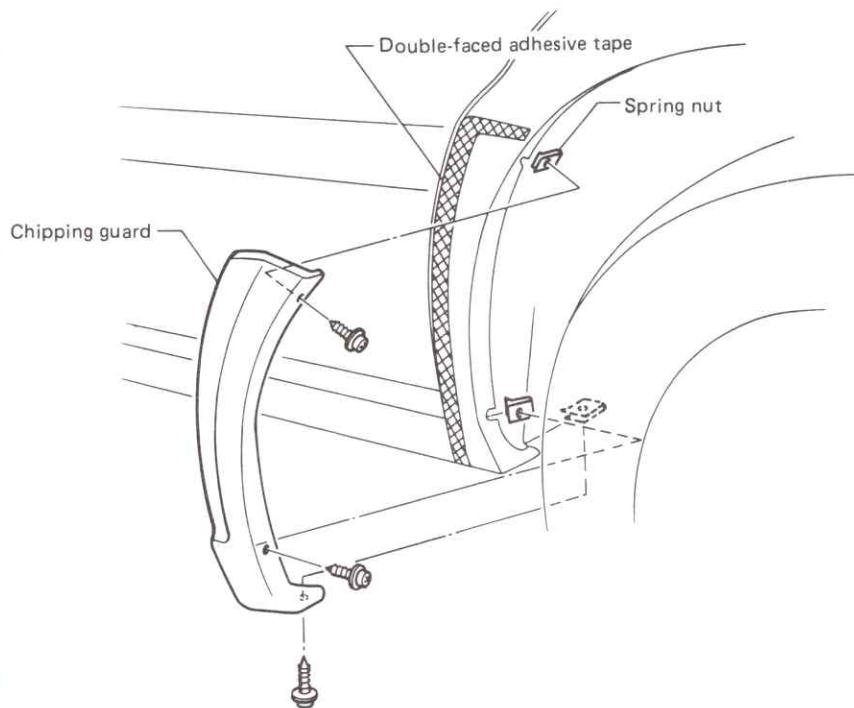


Fig. 13.12 Stone chip guard assembly (Sec 10)

property of the old tape on refitting, but if the tape has lost its tackiness it will be necessary to remove all traces of the old tape using a solvent (caution – some solvents may cause paintwork damage) and to apply new double sided tape to the area shown in Fig. 13.12.

#### *Mudflaps – removal and refitting*

70 Remove the screws securing the mudflap to the wheelarch and lift off the mudflap (photo).

71 Refit in reverse order.

#### *Engine splash panels – removal and refitting*

72 The protective panels under the engine are secured by bolts (photo).

73 Remove the bolts and lift down the panels. Refit in reverse order.

#### *Wheel arch liners – removal and refitting*

74 The wheel arch liners are secured by screws and plastic washers (photo).

75 Remove the screws and lift out the liners. Refit in reverse order.

#### *Fuel filler lid – removal and refitting*

76 All models are fitted with a lockable fuel filler lid.

77 The lock is secured to the lid by a spring clip, which when released allows the lock to be removed (photos).

78 The lid is secured to the bodywork by two screws (photo).

### 11 Electrical system

#### *Battery*

1 Later type low maintenance batteries, which can be identified by having a white blind plug, as opposed to yellow on the earlier types (see Chapter 12), now have a facility allowing them to be refilled with distilled water should the electrolyte level drop below the MIN mark on the side of the battery.

2 To refill a battery, first disconnect the battery terminals; negative first, positive last.

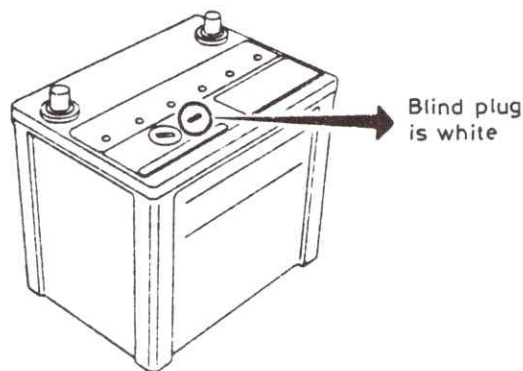


Fig. 13.13 Low maintenance type battery identification (Sec 11)

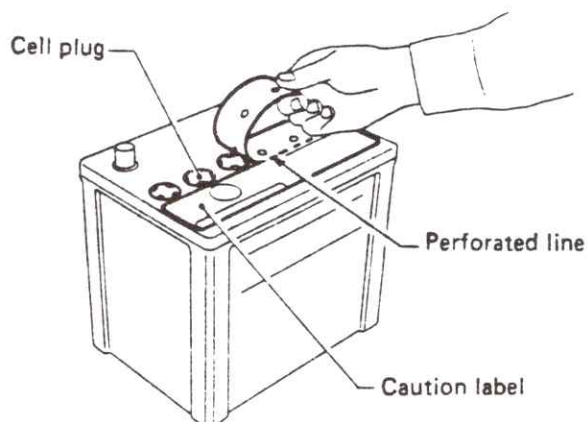
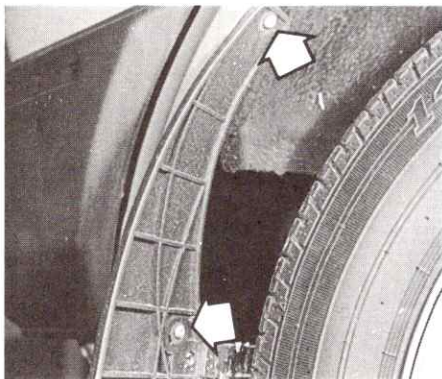
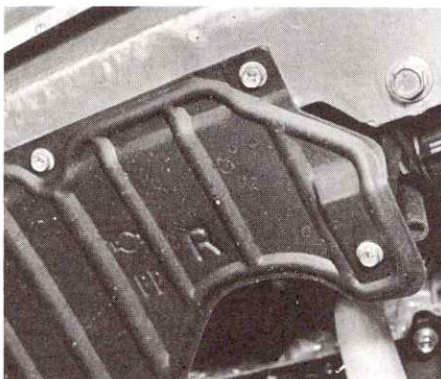


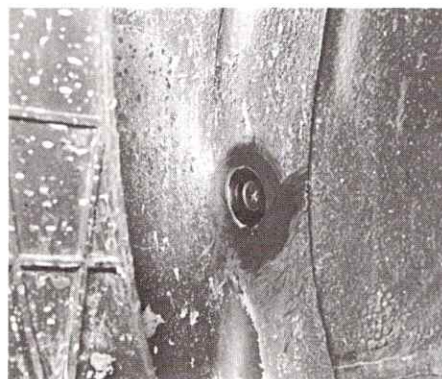
Fig. 13.14 Removing the perforated cautionary label to reveal the cell plugs (Sec 11)



10.70 Mudflap securing screws (arrowed)



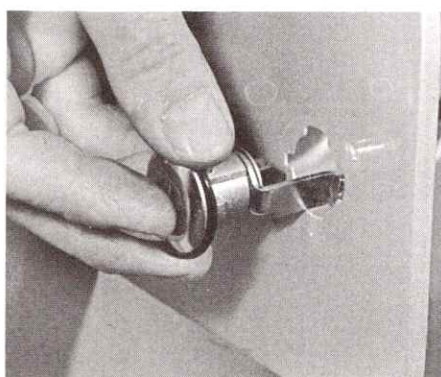
10.72 Engine splash panel securing bolts



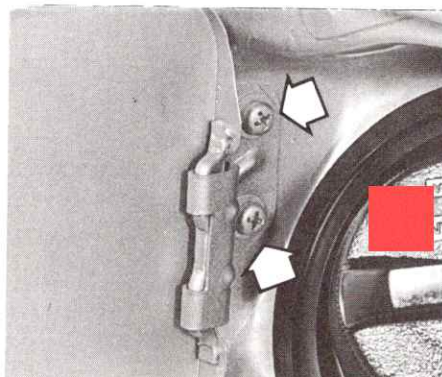
10.74 Wheel arch liner securing screw



10.77A Releasing the fuel filler lid lock securing clip ...



10.77B ... and removing the lock



10.78 Fuel filler lid securing screws (arrowed)

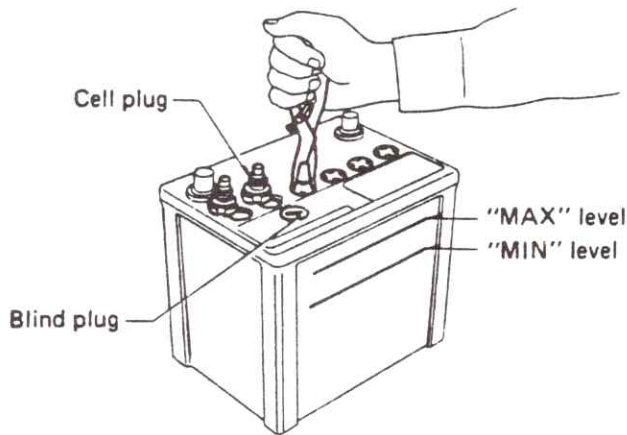
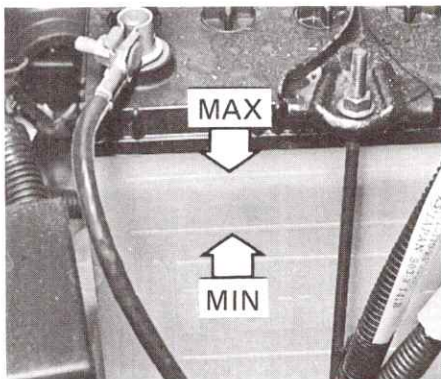
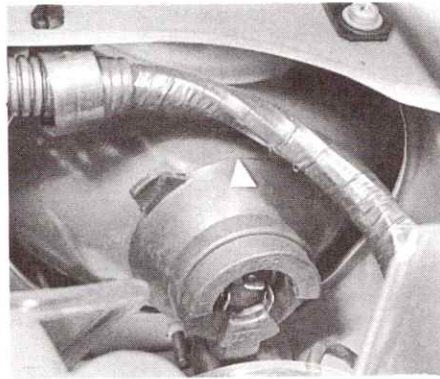


Fig. 13.15 Removing the cell plugs (Sec 11)

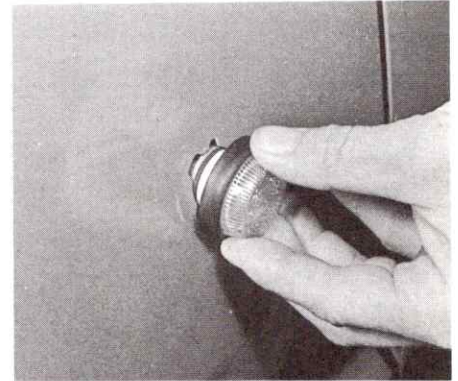
- 3 Remove the perforated part of the cautionary warning label on top of the battery.
- 4 Using snipe-nosed pliers, remove the cell plugs.
- 5 Fill each cell to the MAX level, using only distilled water; mop up any spillage immediately, as the electrolyte is extremely corrosive.
- 6 Refit the cell plugs securely, and reconnect the battery in the reverse order of disconnection.
- 7 More recently, conventional batteries with removable cell plugs and a translucent case through which the electrolyte level can be seen are used.
- 8 With the conventional type of battery, maintain the electrolyte level between the 'MAX' and 'MIN' marks (photo).



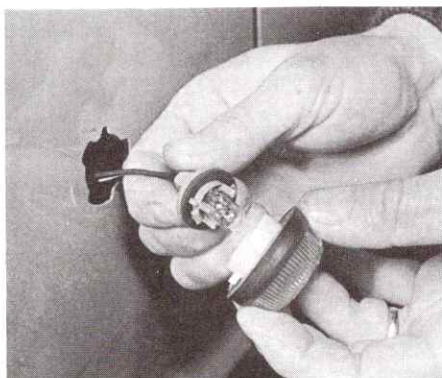
11.8 'MAX' and 'MIN' marks on later type translucent battery



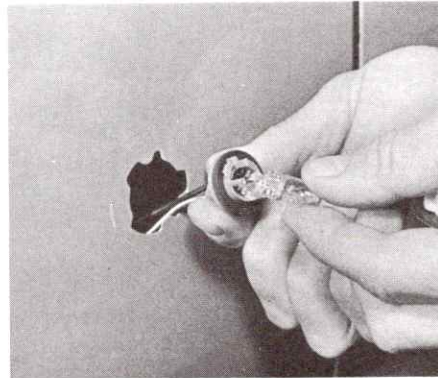
11.10 Correct positioning of the headlamp dust cap



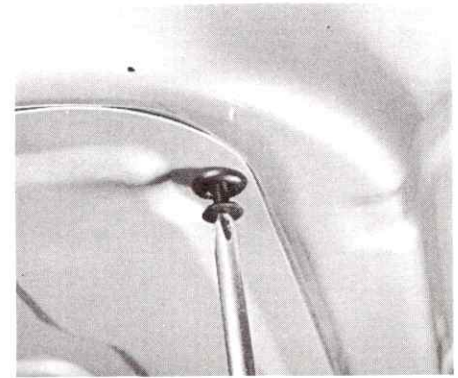
11.14 Removing a side indicator repeater light unit



11.15 Removing the bulbholder ...



11.16 ... and the bulb



11.23A Removing a screw ...

### Lighting units and bulb renewal – 1985 on Headlamp

- 9 The procedure is as described in Chapter 12, except that later models are fitted with a rubber dust cap over the bulb terminals.
- 10 When refitting the dust cap, ensure the 'top' or 'arrow' mark (photo) is uppermost, and 'burp' the dust cap free of air, so that it is a good fit on the headlamp.

### Front combination light (sidelight) and front direction indicator light

- 11 On later models these are of slightly different design; the sidelight being in combination with the headlamp, and the front direction indicator light being mounted in the bumper.

- 12 Bulb and lens renewal is as described in Chapter 12.

### Side indicator repeater light

- 13 Later models have a side indicator repeater light mounted on the front wing.

- 14 To renew the bulb, twist the unit anti-clockwise to release it from the wing (photo).

- 15 Twist and pull the lens from the bulbholder (photo).

- 16 The bulb is a push fit in the holder (photo).

- 17 Refit in reverse order.

### Rear combination lights

- 18 The rear combination light formation has been changed, but the procedure for bulb renewal is as described in Chapter 12.

- 19 To remove the lens unit, remove the plastic cover in the luggage compartment as for bulb renewal.

- 20 Four nuts secure the lens cover to the light unit.

- 21 Remove these nuts and gently lever off the lens cover.

- 22 Refit in the reverse order.

### Rear number plate lights (up to 1987)

- 23 To gain access to light units for bulb changing, first remove the access panel on the inside of the tailgate (photos).

- 24 The bulbholder is a bayonet fix in the light unit and can be removed by twisting and pulling it from the unit (photo).

- 25 To remove the complete unit, undo the two nuts securing the unit to the tailgate and gently prise it away (photo).

26 Refit in reverse order.

### Rear number plate lights (1987 on)

27 There are two light units, one at each side of the number plate.

28 To renew a bulb, first remove the trim panel from the inside of the tailgate.

29 Although the bulbholders can be reached and removed by twisting and pulling them from the tailgate skin, because of the limited access we found it easier to undo the two nuts securing the unit to the tailgate, then lift off the unit and remove the bulbholder from the unit (photos).

30 Refit in reverse order.

### Rear foglight and reflector unit

31 The rear foglight and reflector units are mounted in the rear bumper.

32 The right-hand unit is the foglight, and the left-hand unit is the reflector.

33 To remove both units, undo the two retaining screws (photo).

34 This will release both the lens and the light unit (photo).

35 To remove the complete unit, disconnect the electrical connector (photo).

36 The bulb is a bayonet fix in the holder.

37 Refit in the reverse order.

### Luggage compartment lamp

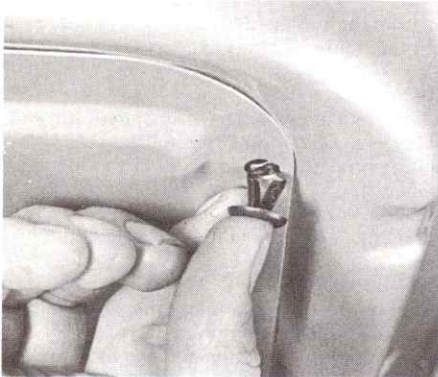
38 To renew the bulb, prise off the lens cover. The bulb is of the festoon type held between two spring contacts (photo).

39 To remove the complete lamp unit, undo the two securing screws and disconnect the leads at the rear of the unit (photo).

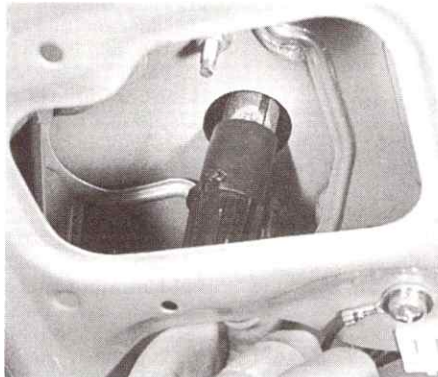
40 Refit in reverse order.

### Courtesy light microswitches – all models

41 The courtesy light is operated by microswitches mounted in each door pillar.



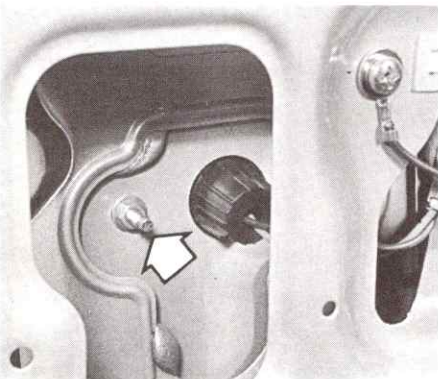
11.23B ... and clip from the access panel in the tailgate



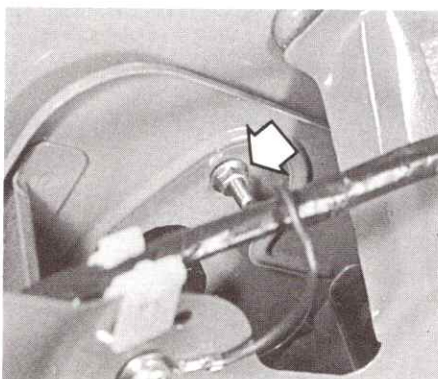
11.24A Pulling out the number plate light bulbholder



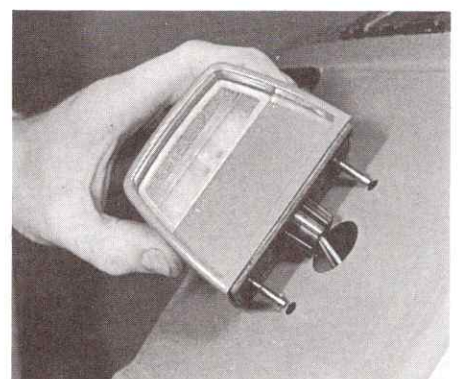
11.24B Removing the bulb



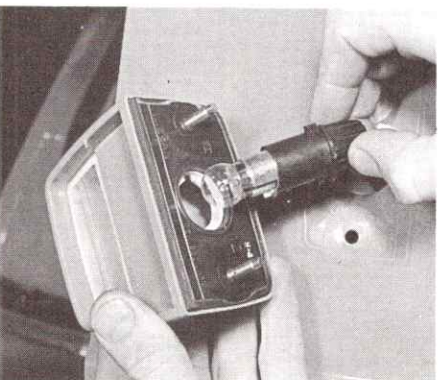
11.25 Number plate light retaining nut (arrowed)



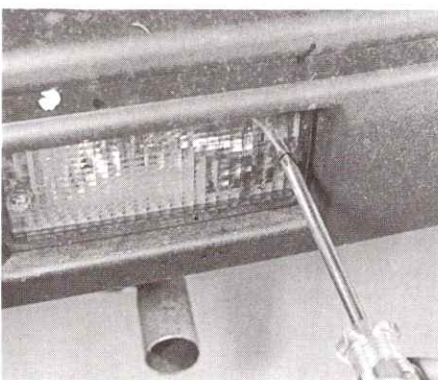
11.29A Number plate light retaining nut on 1987 on models (arrowed)



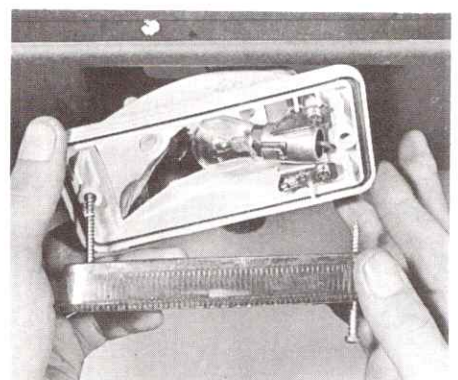
11.29B Lifting off the light unit ...



11.29C ... and removing the bulb and holder



11.33 Removing a foglamp retaining screw



11.34 Separating the lens from the unit

42 To remove a microswitch, remove the retaining screw, and carefully lift out the microswitch pulling the electrical lead and connector from the hole in the door pillar (photo).

43 Disconnect the electrical lead, transfer the rubber cover to the new microswitch and refit in the reverse order.

#### *Instrument panel (1987 on) – general*

44 On later models an analogue clock replaces the digital clock fitted to earlier models.

45 The analogue clock is mounted in the instrument panel.

46 Removal and refitting of the instrument panel remains as described in Chapter 12, Section 19.

#### *Radio (standard equipment) – removal and refitting*

47 Remove the ashtray from the facia panel by pulling it forwards and tilting it downwards to release it from its housing.

48 Remove the two screws securing the radio to the facia (photo).

49 Pull the radio forwards and disconnect the wiring plug and aerial lead (photo).

50 Refit in reverse order.

#### *Radio aerial (standard equipment) – removal and refitting*

51 Disconnect the aerial from the rear of the radio unit.

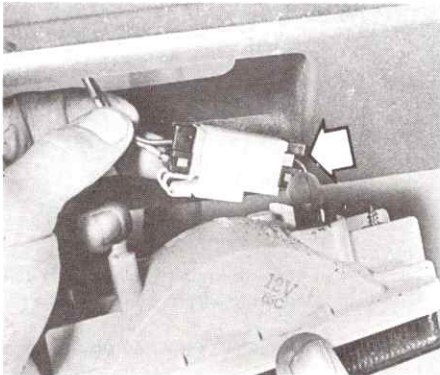
52 Undo the screw securing the aerial moulding to the front wing (photo).

53 Pull the aerial upwards, at the same time feeding the aerial lead through the facia and bodywork (photo).

54 Refit in reverse order.

#### *Dim-dip headlamp lighting system – general description*

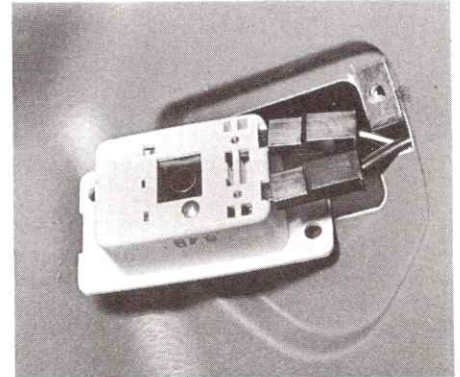
55 From late 1986, all models are equipped with a headlamp dim-dip lighting system.



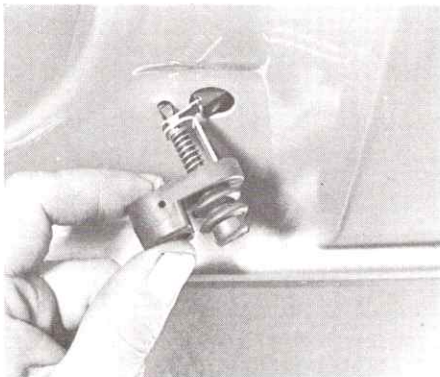
11.35 Foglamp connector (arrowed)



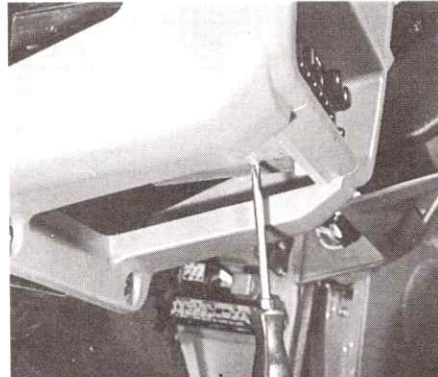
11.38 Luggage compartment lamp with lens removed



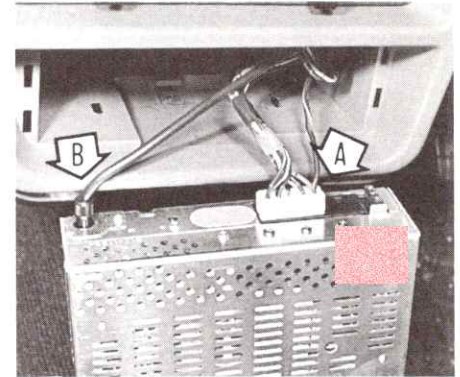
11.39 Lamp unit removed showing the connections at the rear of the lamp



11.42 Removing a courtesy light microswitch



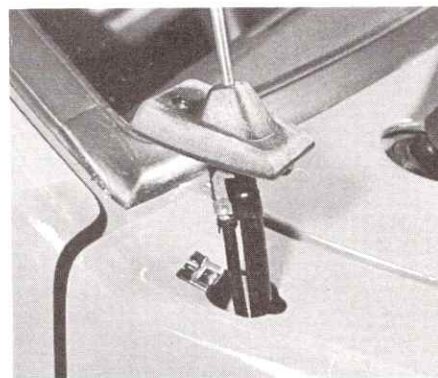
11.48 Removing the radio securing screws



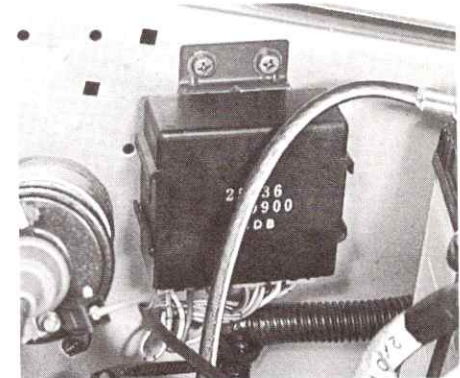
11.49 Radio removed showing wiring plug (A) and aerial lead (B)



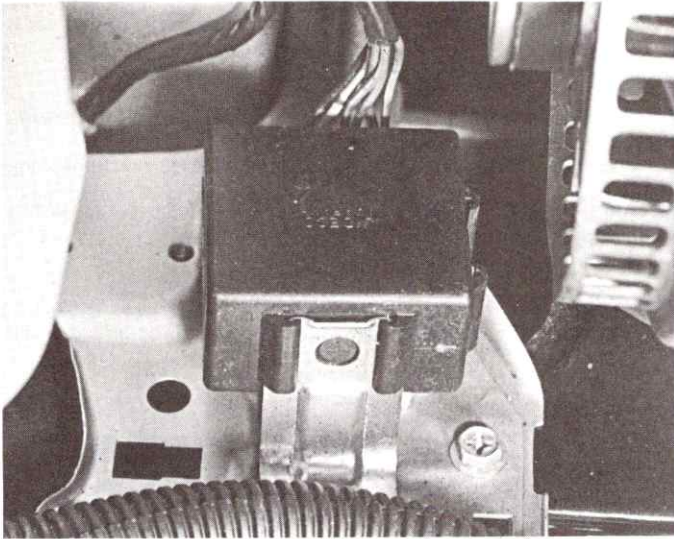
11.52 Removing the aerial moulding retaining screw



11.53 Pull the aerial upwards



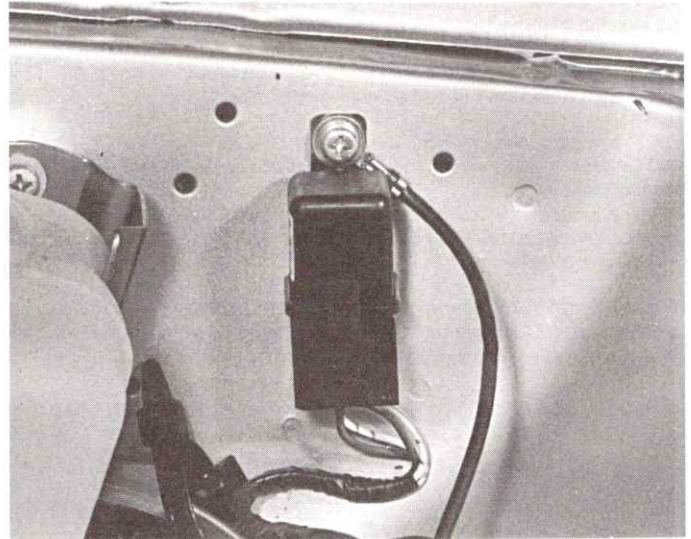
11.57 Dim-dip lighting control unit on left-hand inner wing



11.58 Intermittent wipe relay on front panel (later models)

56 This system enables the headlamps to be operated at a brightness greater than that of the sidelights, but without the glare associated with dipped main beam.

57 A dim-dip lighting control unit is mounted on the left-hand inner wing (photo), and a wiring diagram appears at the end of this Supplement.



11.59 Automatic choke relay on inner right-hand wing (later models)

#### *Fuses and relays – location*

58 On later models, the location of the intermittent wipe relay has been changed. The relay is now situated on the front panel, just to the right of the radiator (photo).

59 On later models, the automatic choke relay is located on the inner right-hand wing (photo).

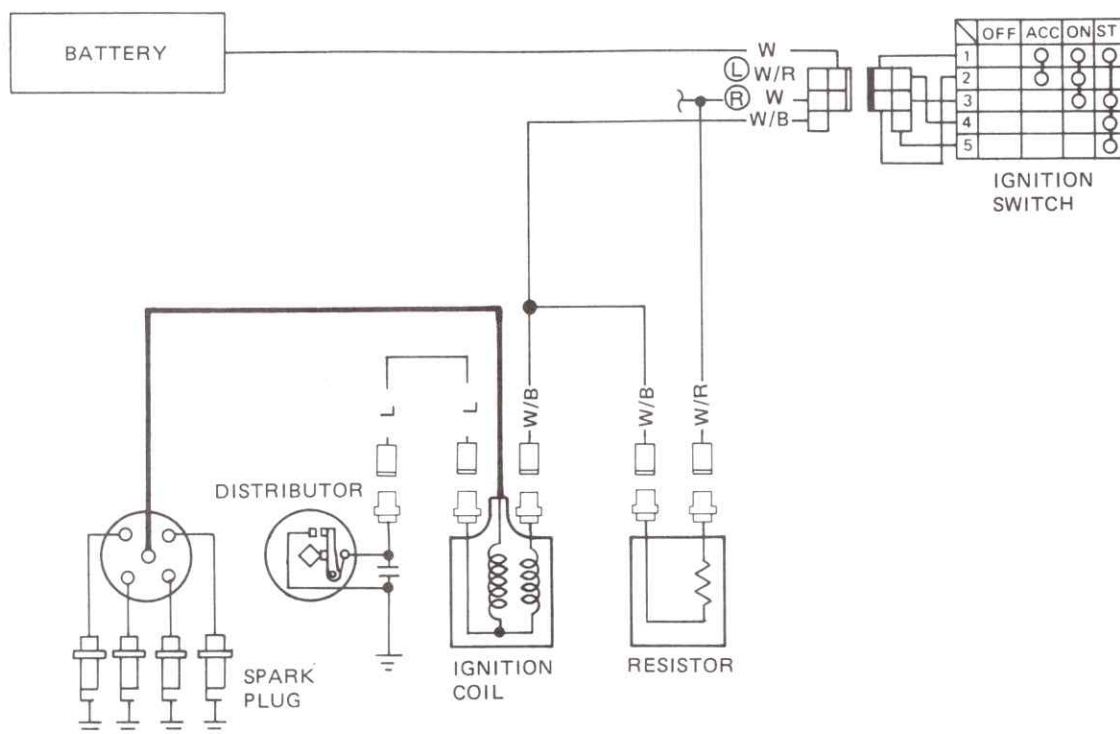


Fig. 13.16 Wiring diagram, ignition circuit – 1985 on

For colour code see page 218

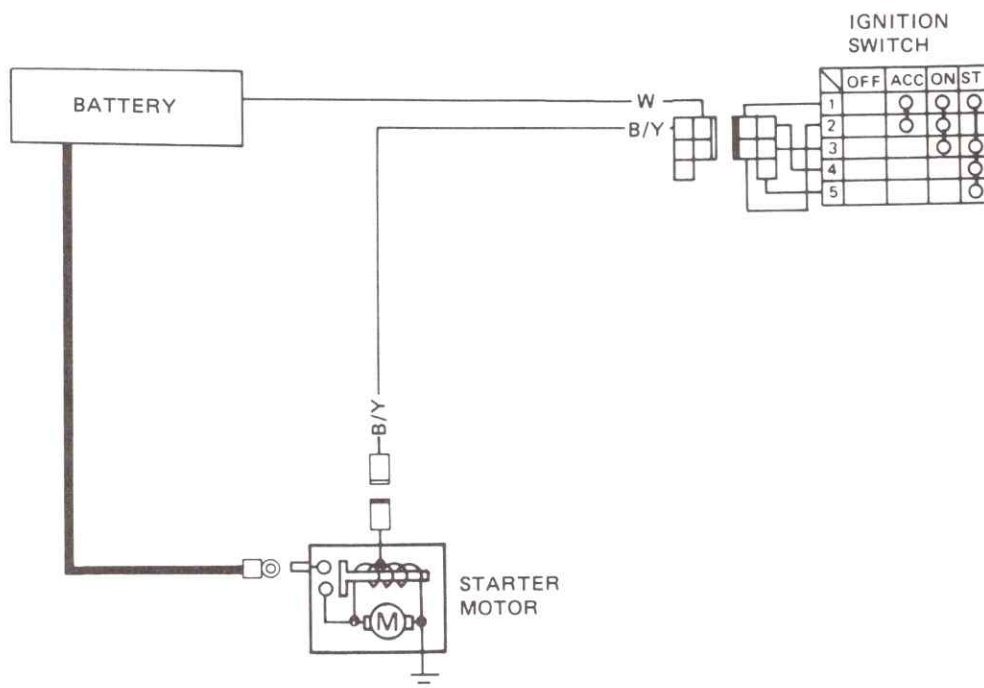


Fig. 13.17 Wiring diagram, starting circuit (manual transmission) – 1985 on

For colour code see page 218

Fig. 13.18 Wiring diagram, starting circuit (automatic transmission) - 1985 on

For colour code see page 218

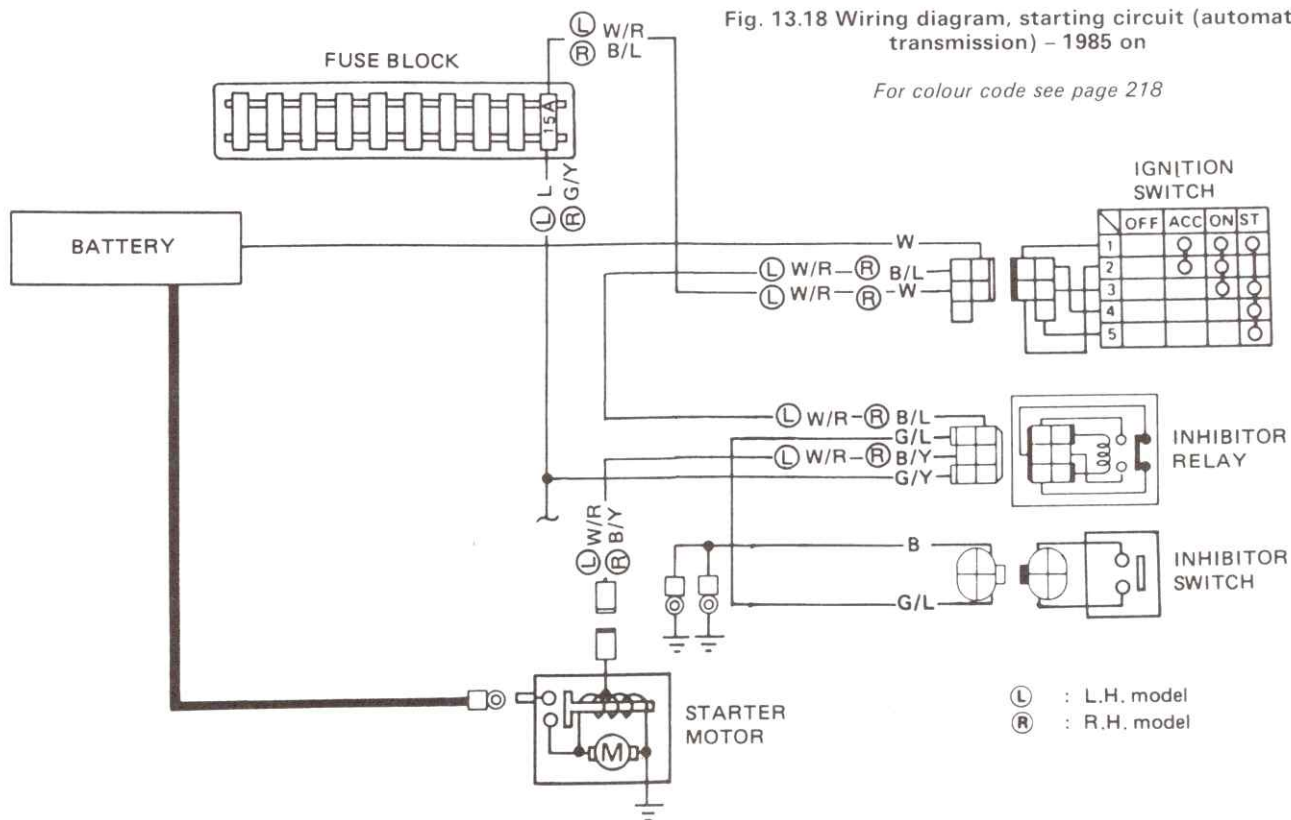
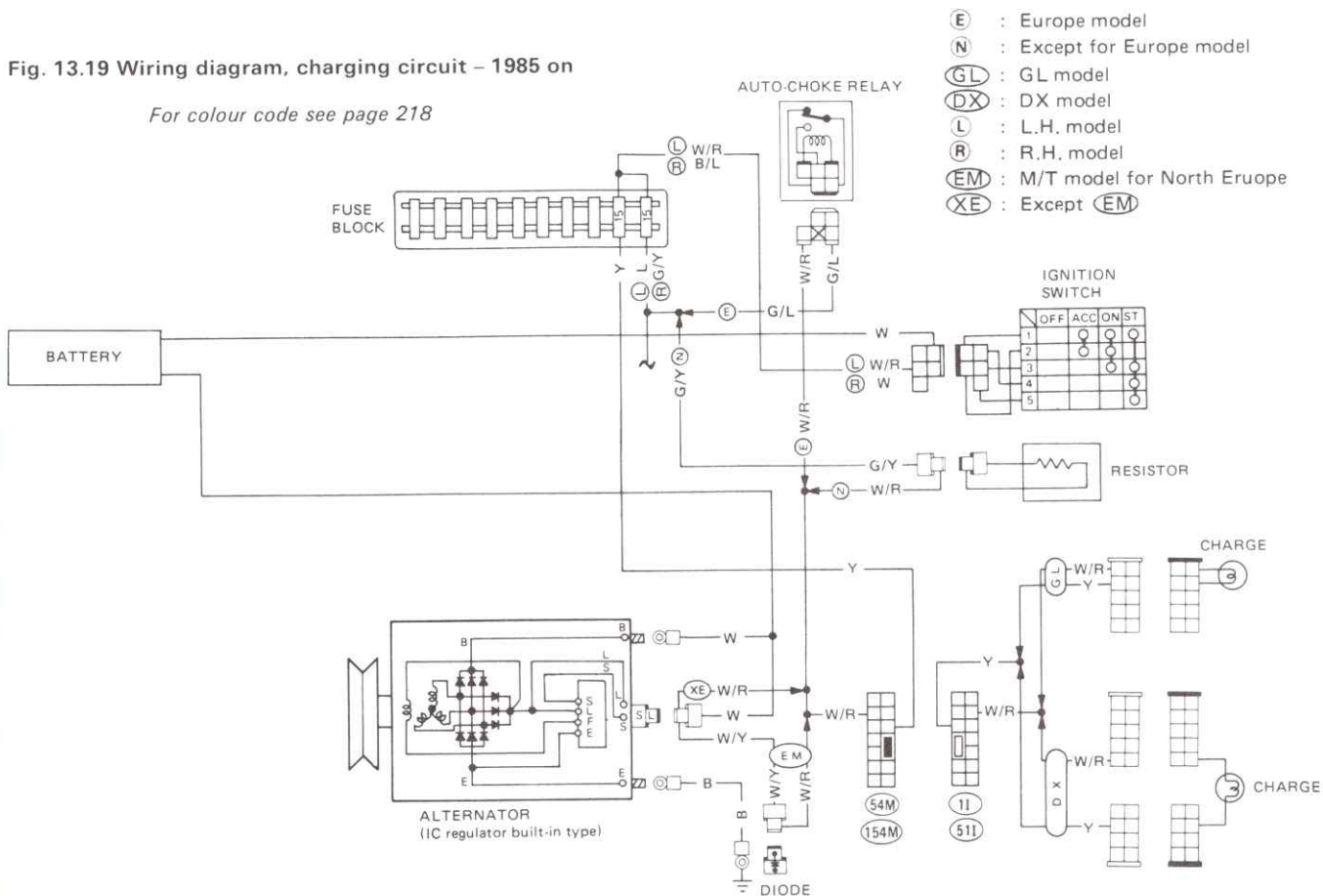


Fig. 13.19 Wiring diagram, charging circuit - 1985 on

For colour code see page 218



## R.H. drive model

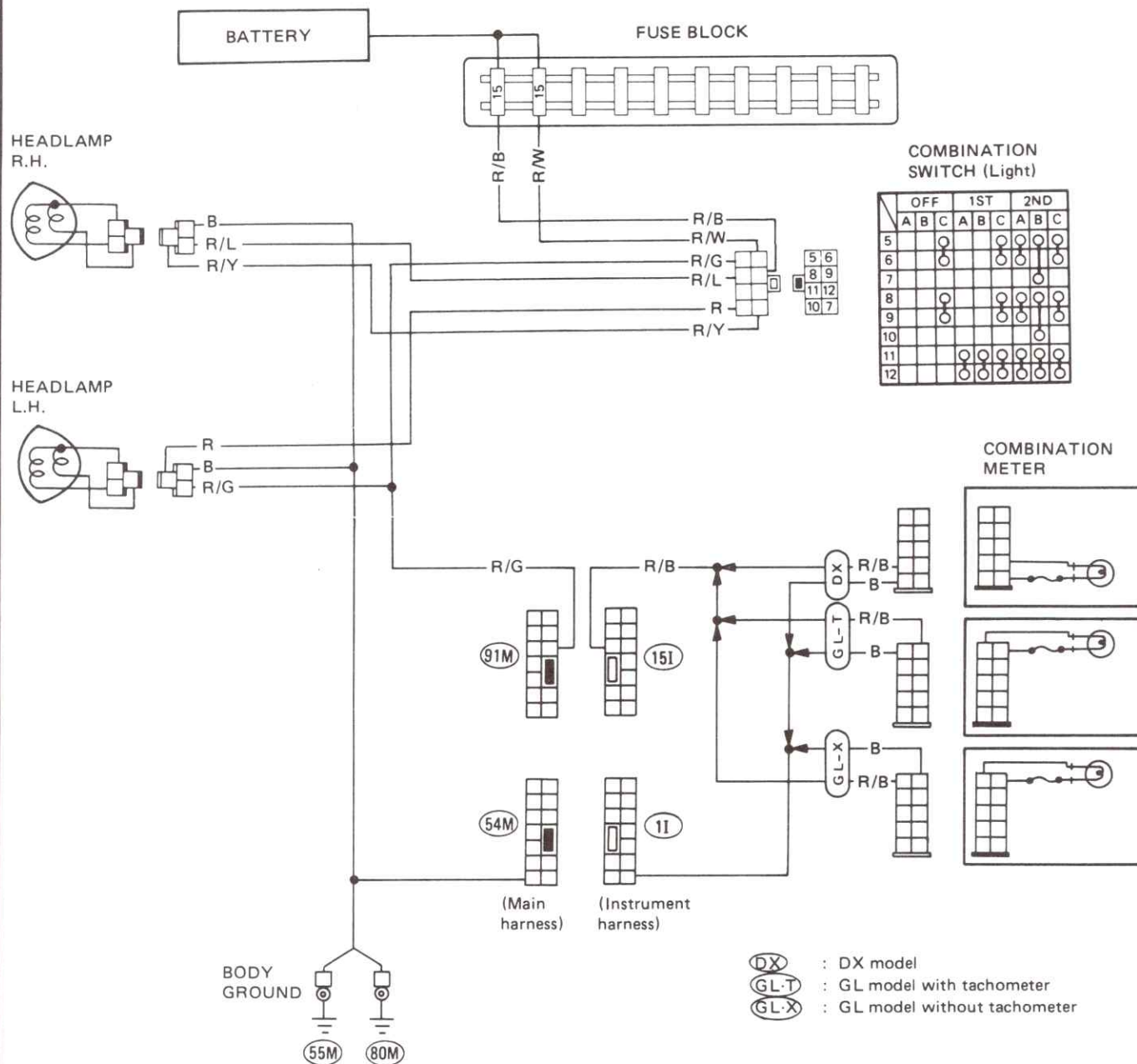


Fig. 13.20 Wiring diagram, headlamp circuit – 1985 on

For colour code see page 218

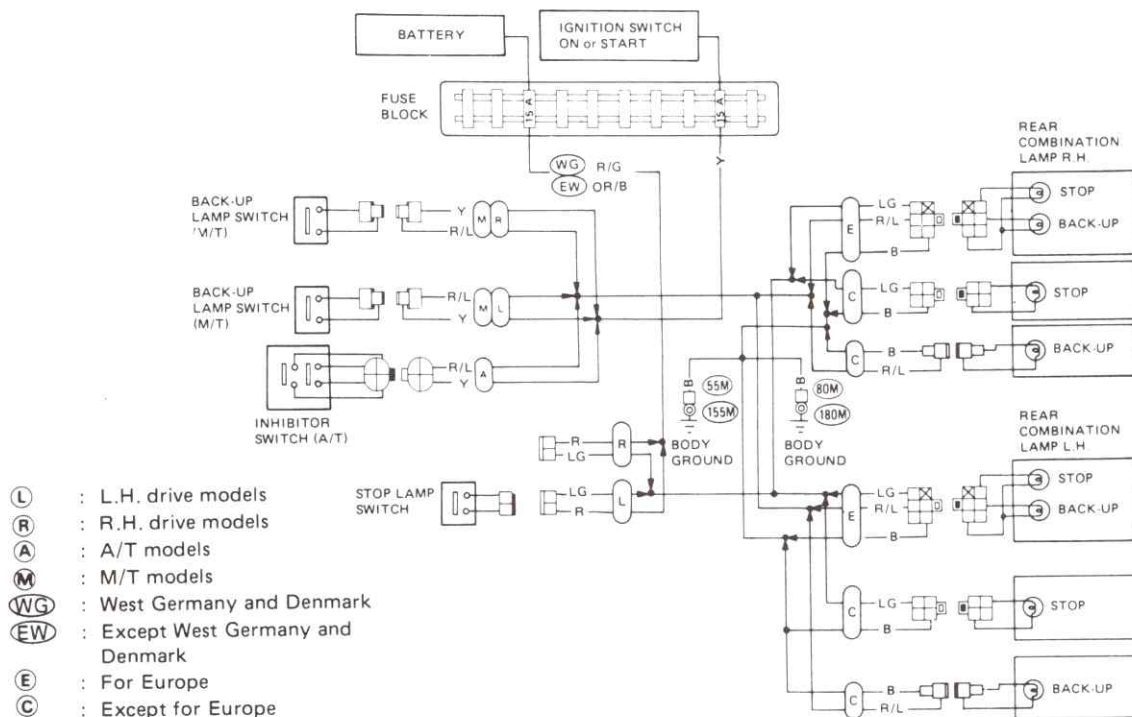


Fig. 13.21 Wiring diagram, brake light and reversing light circuit - 1985 on

For colour code see page 218

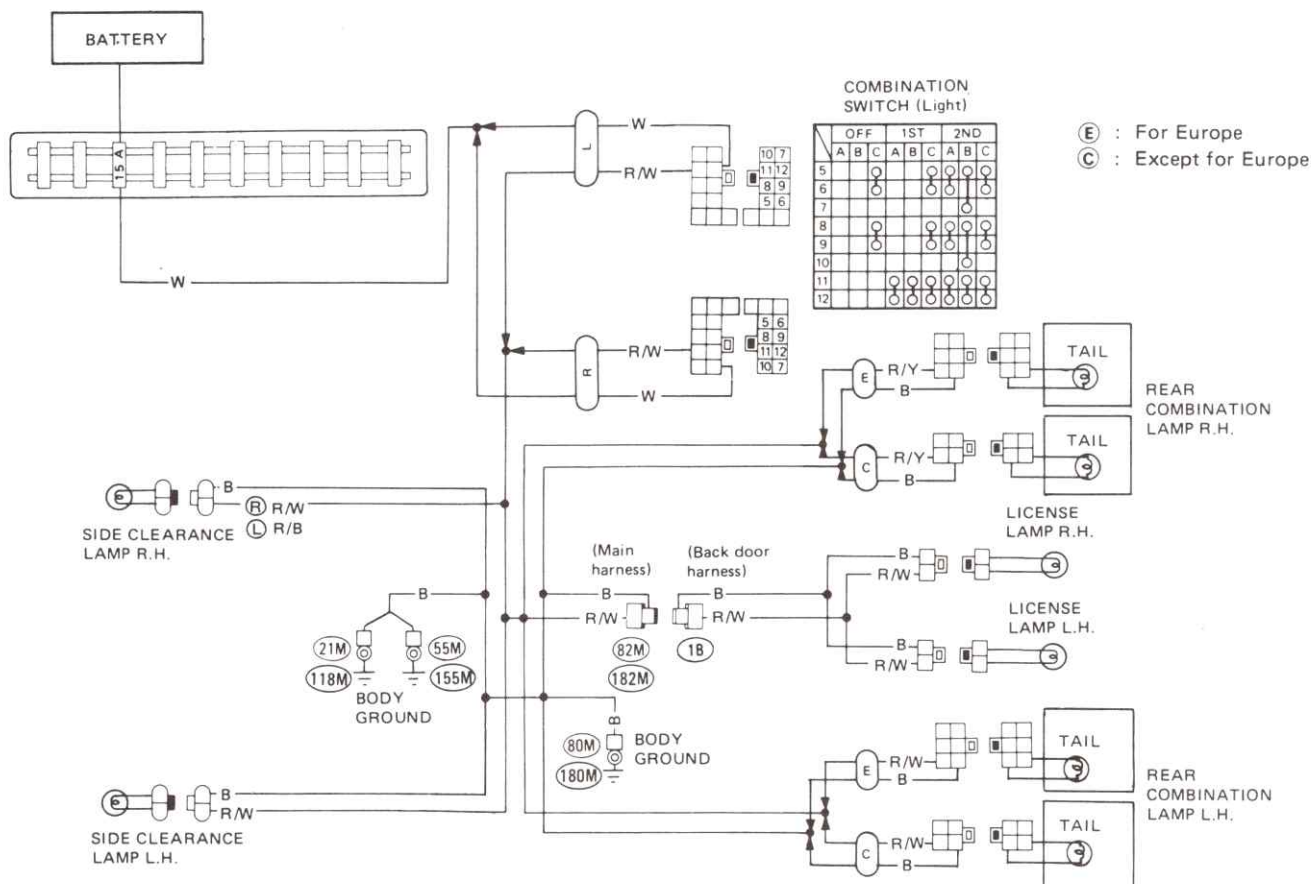


Fig. 13.22 Wiring diagram, side, number plate and rear light circuit - 1985 on

For colour code see page 218

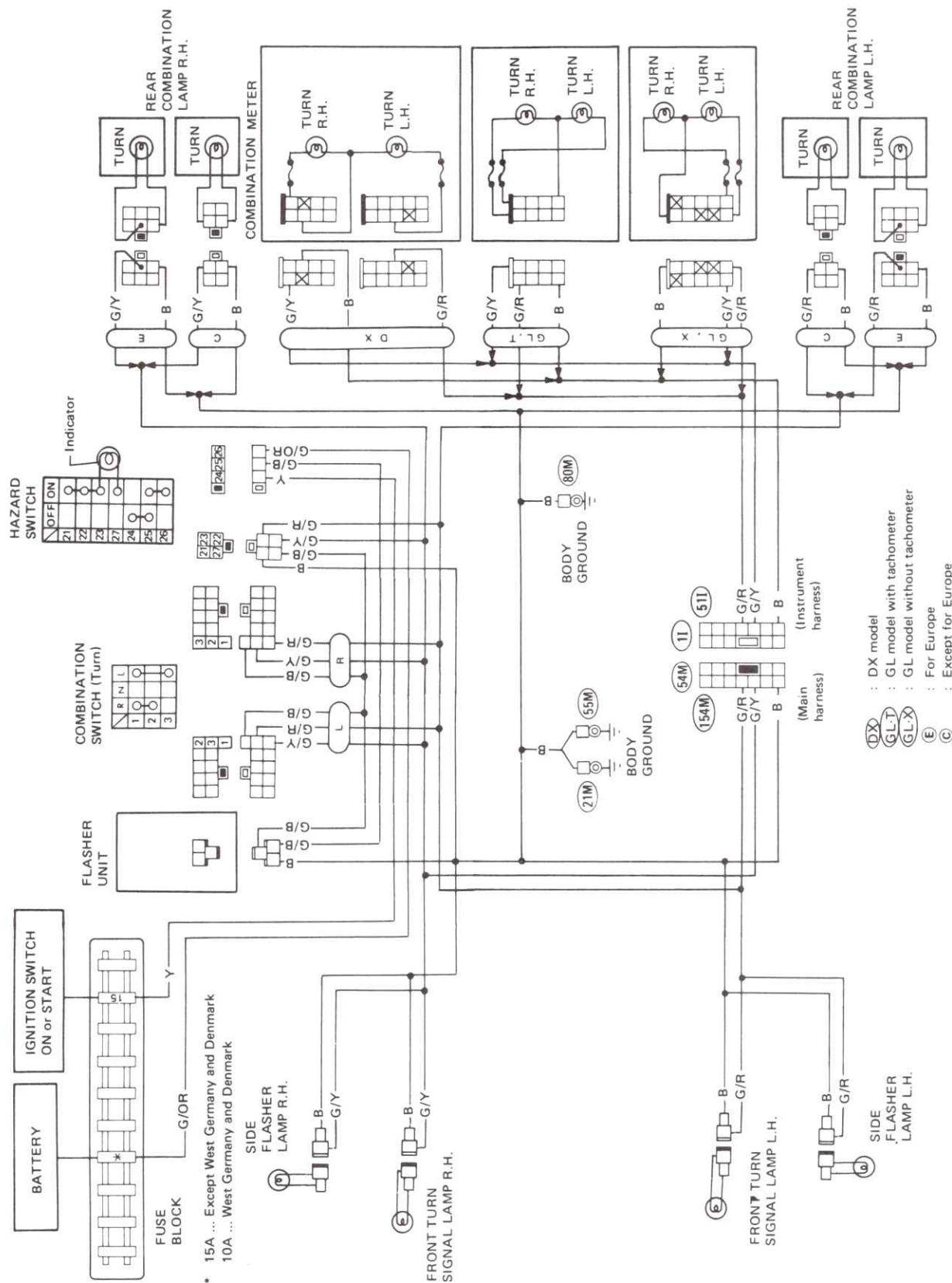
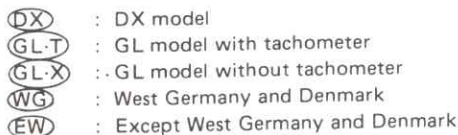
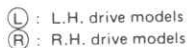


Fig. 13.23 Wiring diagram, indicator and hazard warning light circuit – 1985 on

For colour code see page 218



*For colour code see page 218*



*For colour code see page 218*

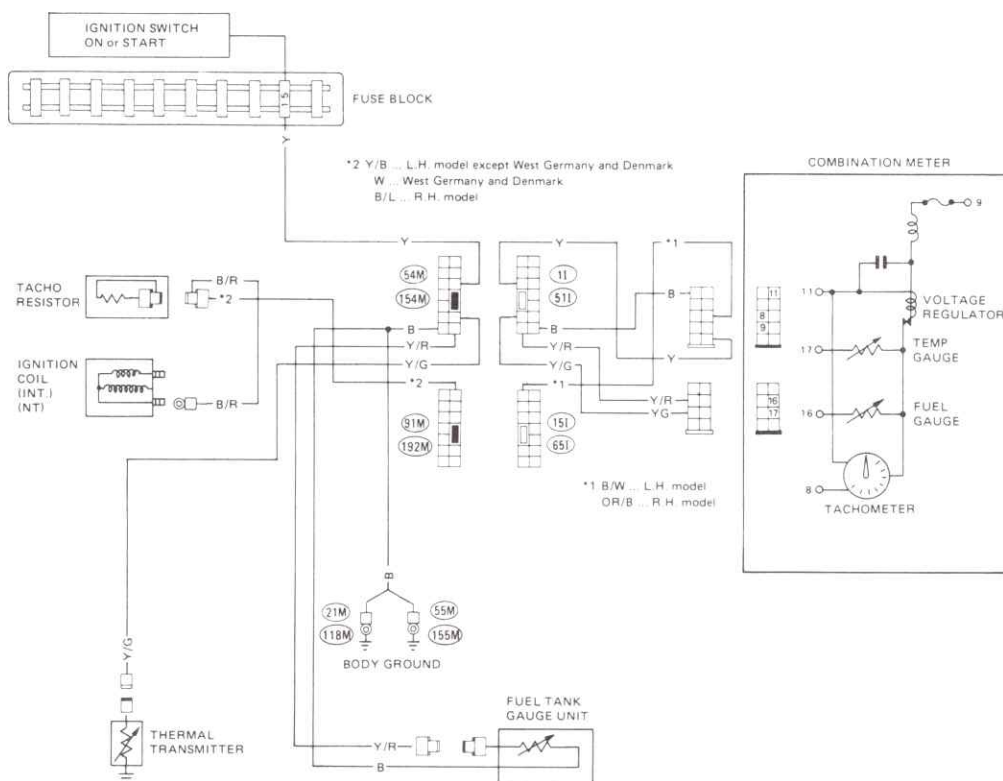


Fig. 13.26 Wiring diagram, instrument circuit (with tachometer) - 1985 on

For colour code see page 218

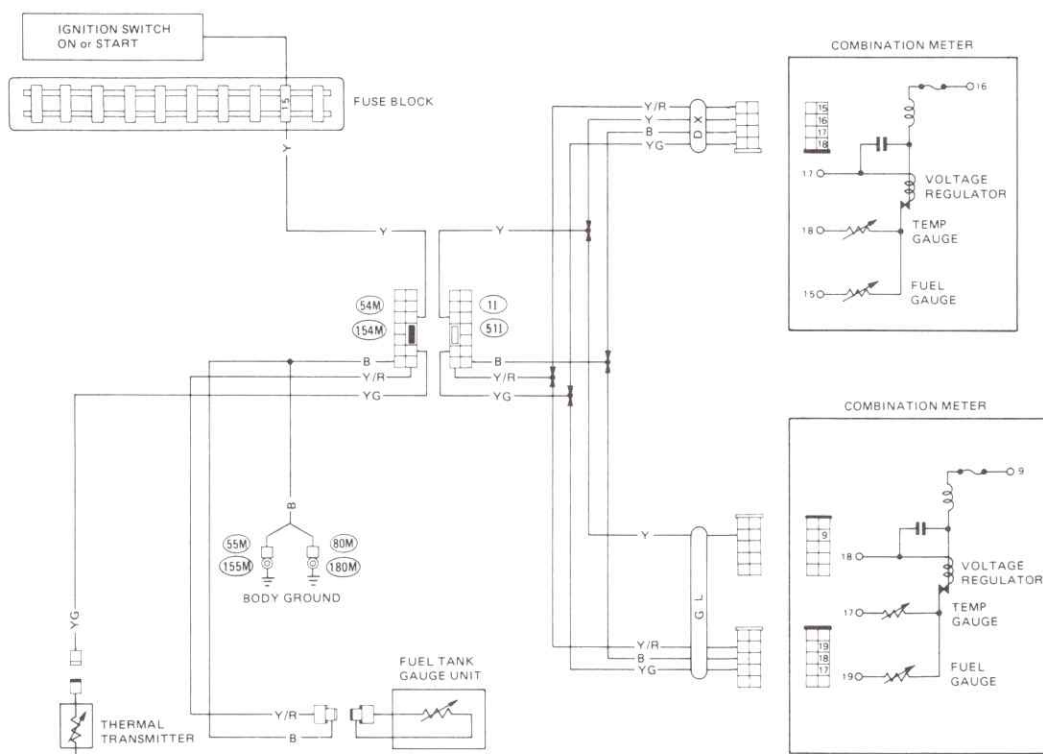


Fig. 13.27 Wiring diagram, instrument circuit (without tachometer) - 1985 on

For colour code see page 218

Fig. 13.28 Wiring diagram, warning light circuit – 1985 on

For colour code see page 218

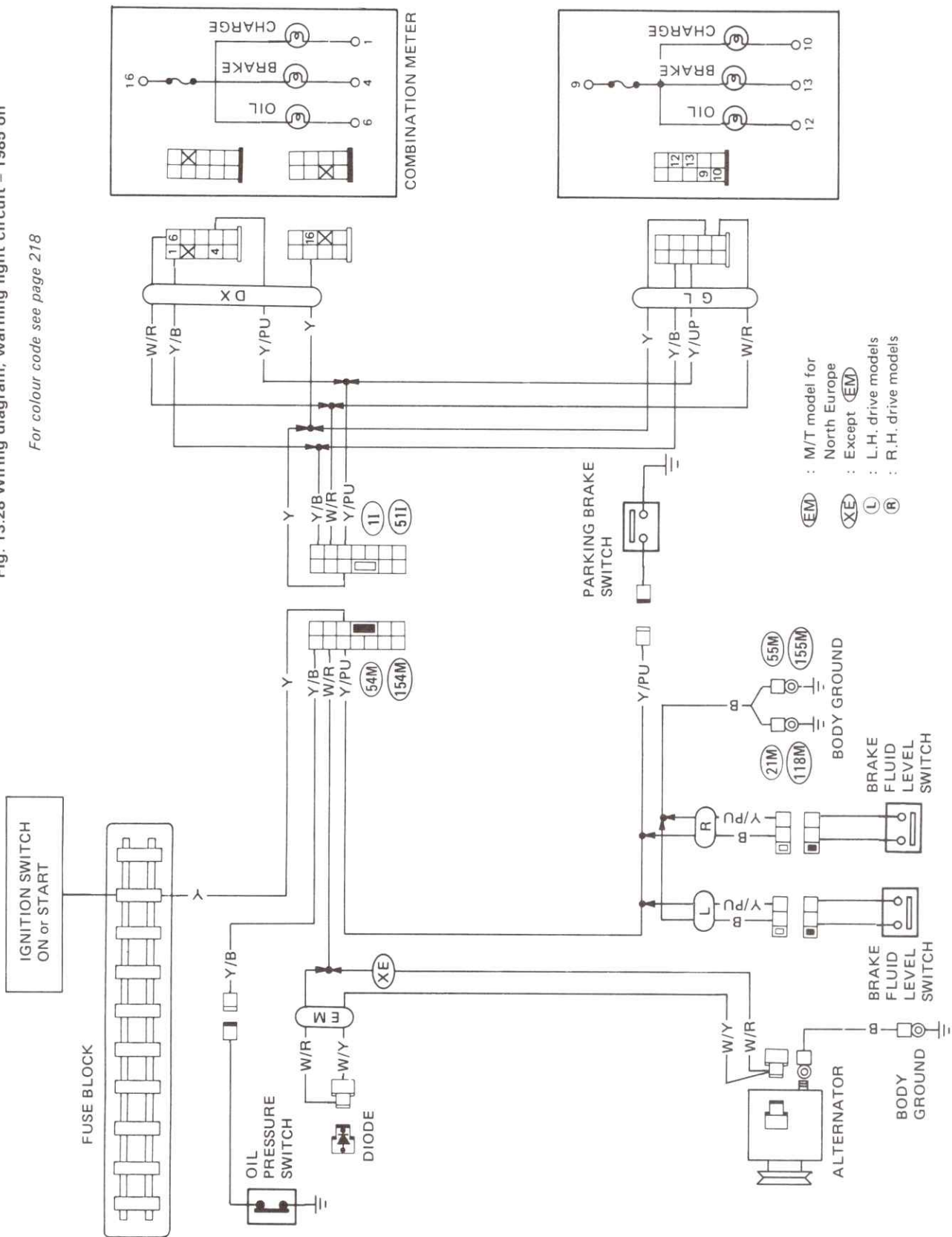


Fig. 13.29 Wiring diagram, rear screen demister circuit – 1985 on

For colour code see page 218

# R.H. DRIVE MODEL To lighting switch

(HSU) : For Hong Kong, Singapore and R.H. drive models for Europe  
 (EHSU) : Except above

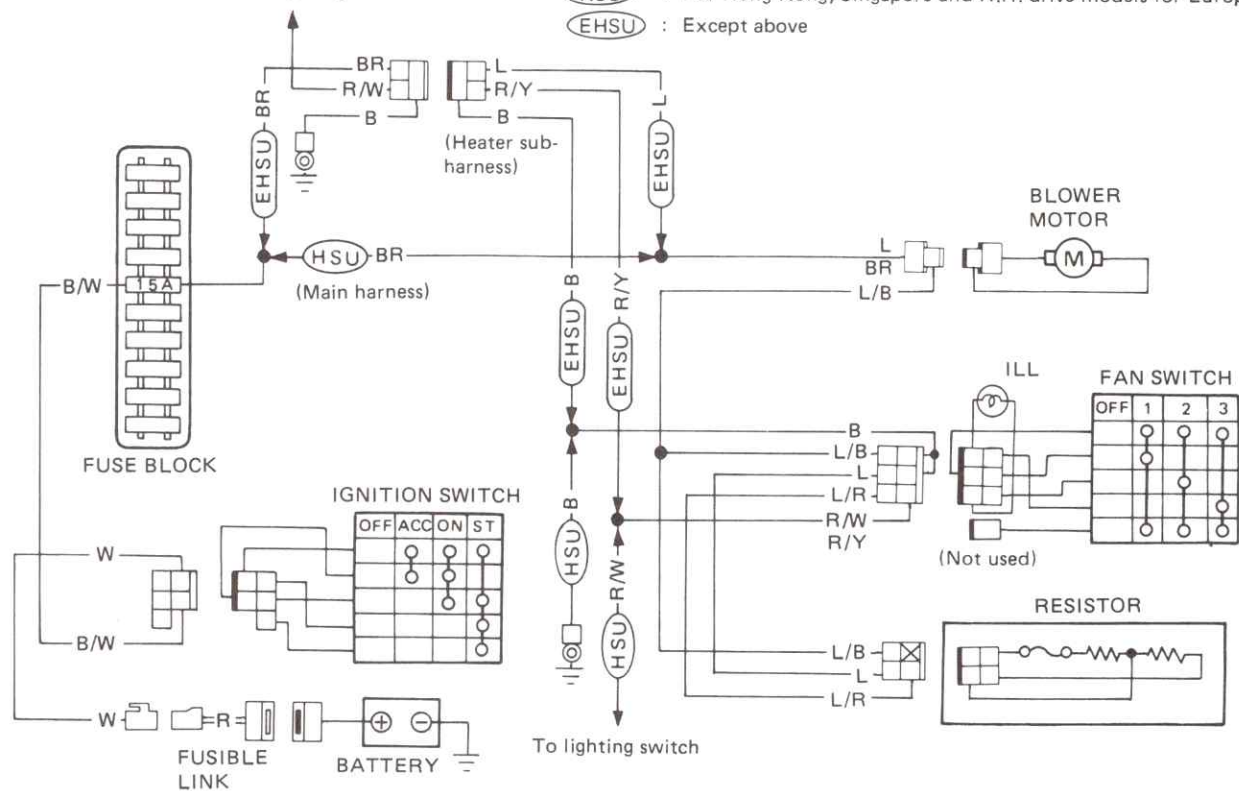


Fig. 13.30 Wiring diagram, heater circuit – 1985 on

For colour code see page 218

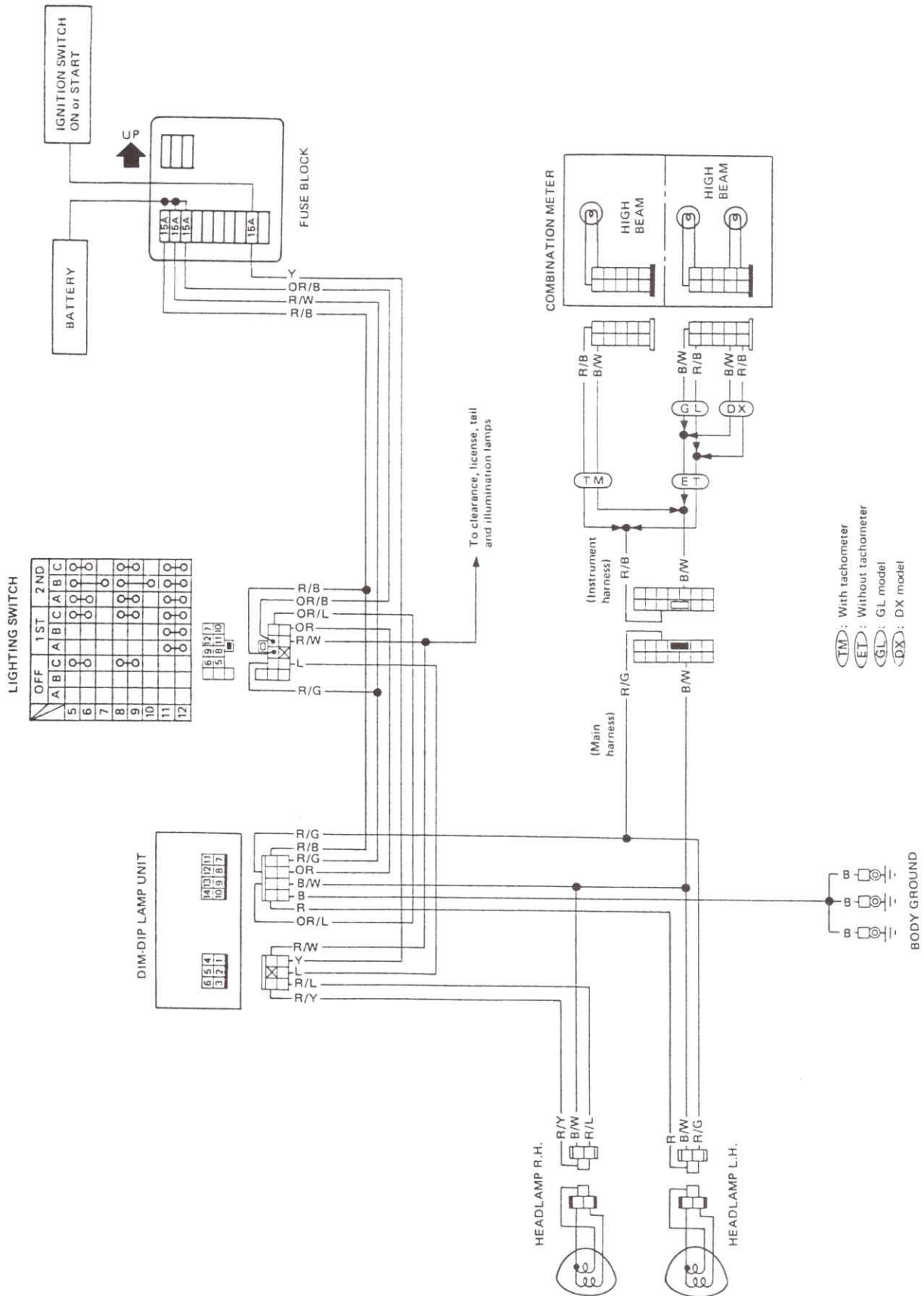


Fig. 13.31 Wiring diagram, dim-dip lighting circuit - 1986 on

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